EDITORIAL

ALTHOUGH I hope to see a good deal more television before I return to Australia, I have been the temporary possessor of a receiver for some weeks, and one point is emerging very clearly.

It is this—without good programs the hopes held for a healthy Australian TV service will not materialise and, if they do, it will be in the face of a public sales resistance.

I have now seen TV of sorts in seven different countries, and in every one of them program quality has been the subject of the most prolific comment.

Undoubtedly there are many excellent programs. The major highlights, such as the Queen's Coronation, are still spoken of in the highest terms all over Europe.

But highlights are not enough to make a happy owner of a TV set, nor is it right that they should. Receivers cost money, and we must be vitally concerned with the stock programs which make up the bulk of viewing time.

Some I have seen have frankly been boring. Fortunately Britain is well served technically, but in Europe I saw programs which produced ridicule and hostility in the audience—emotions unmistakable in any language.

The problems of creating consistent visual appeal are many, and I cannot believe that the technique as I have seen it so far is good enough to hold Australian interest for longer than the initial period.

It would be far better to commence with restricted hours than to fill in with poor material. If Britain with her resources is unable to provide a quality day-long service through limited channels, we must expect the prospects for Australia to be even less hopeful.

I think we will reach the (highly) critical stage much sooner than they did in Britain, for we will have the invaluable element of competition right from the beginning, with both national and commercial stations. Personally, I think commercial TV in Britain, even in its present restricted form, was overdue, not because the BBC is doing a bad job, but because it is not good to have a single line of thought providing the only radio or TV outlet.

Some tolerance will be expected and will be given to our first efforts, but it would be a fatal mistake to imagine that anything will do for a start. TV demands the highest degree of attention from the viewing public, more than any other form of entertainment, and its immediate future will depend largely on first impressions.

John Moyle

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RADIO TELEVISION & HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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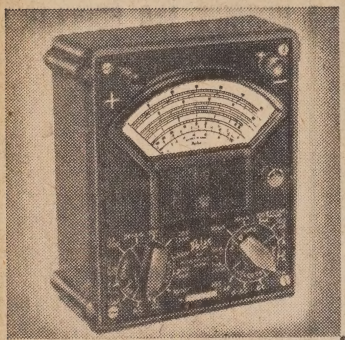
OUR COVER PICTURE

Radio-frequency heating has provided the answer to a long-standing riddle — how to braze aluminium and certain other metals which cannot be brazed by ordinary heating methods. Here, special RF brazing apparatus is being used to fabricate a cavity magnetron, which is very widely used in modern radar equipment.

Palec

5 PRE-EMINENT MULTI-RANGE INSTRUMENTS



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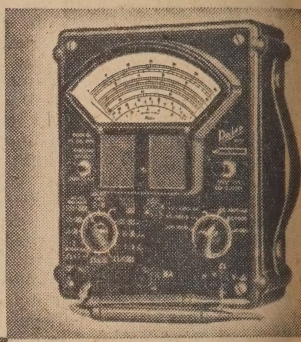

MODEL M42. Forty-two range. General Purpose Multimeter:—
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Resistance: 0-5 Megohms (Int. Batteries).
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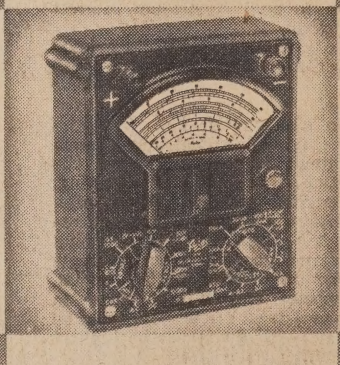

MODEL M 52. Fifty-two range Laborator Multimeter covering:—
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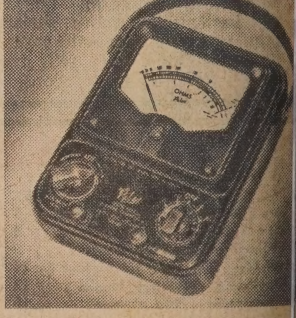

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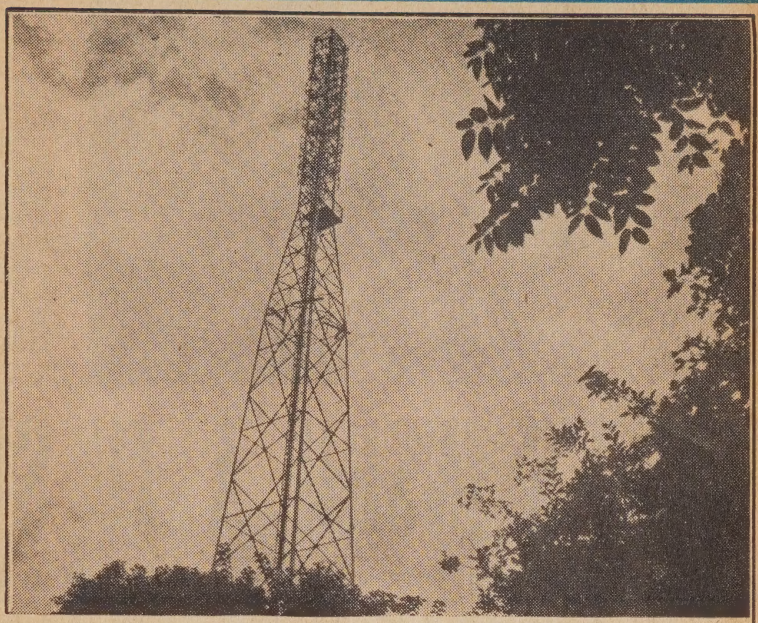
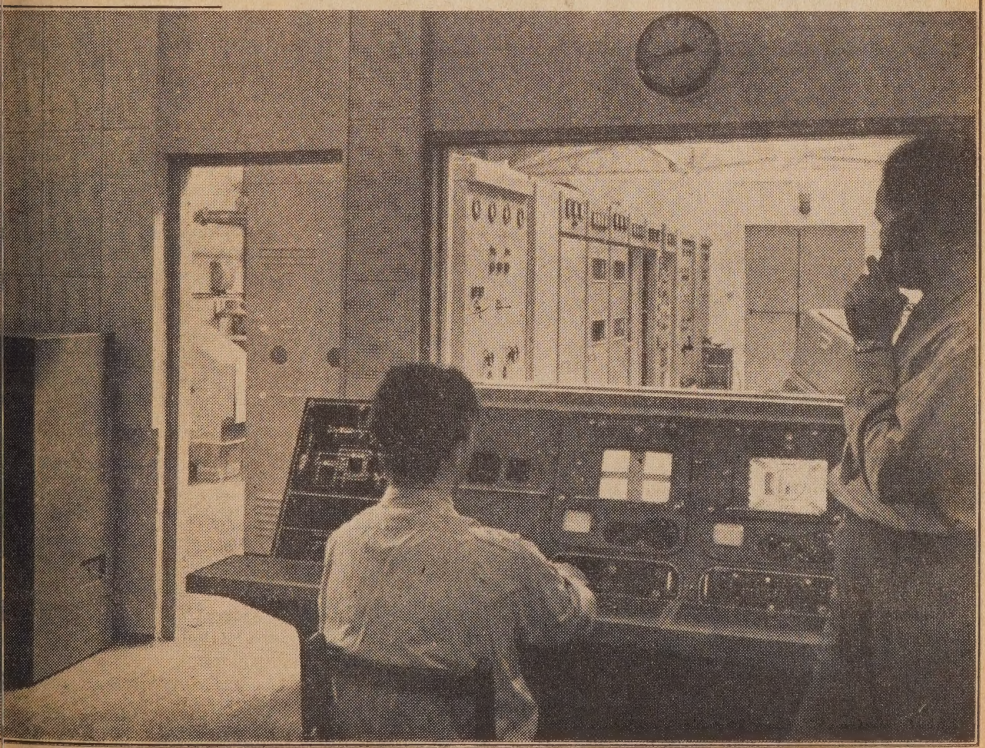
WHERE TV SIGNALS COME FROM

OM the 8-stack array atop its huge tower, the I.T.A. ion radiates Britain's first mercial television programs. w is seen the transmitter which houses the transmitters control gear, built by the coni's Wireless Telegraph Co in collaboration with I.T.A. neers. Much of the equipment duplicated as a safeguard inst breakdown, which can be costly in a commerical TV ure. From the control desk he foreground the operator s a continuous check on the ration of the transmitter and on the program.

fore transmission commences day a variety of test patterns nt from the studio system to transmitting centre to check elevant circuits.

utside broadcasts, which may cable or microwave relay links fed initially to the Master trol Room, pictured on the wing pages. Here they are grated with dramatic presentns from the studios, with ouncements or advertising er, as required. (See pictures story on the following pages).





Looking down into Studio 1 at the Wembley Television Centre from the lighting control position. Two trolly-mounted cameras are seen on the floor in the foreground, trained on the scene at the extreme left. Another "kitchen" set can be seen at the centre right.

WHAT'S INSIDE A TV STATION?

Right now, in Sydney and Melbourne, aerial masts, station buildings and studios are taking shape for Australia's first group of television stations. However, few of the ultimate viewers have any real appreciation of the facilities which must be provided before programs can go on the air.

TO an audience, long accustomed to viewing movies in a theatre, the image which appears on the end of a television picture tube may appear quite ordinary, quite commonplace. But spare a thought for the engineers, the tradesmen, the producers, the actors and the equipment, which brings it into your home every day of the week.

First and foremost, television is NOT what a lot of people currently imagine it to be—a mere addition to sound broadcasting.

Television is NOT a gadget which lets you peek into your favorite radi station.

It is not a means of bringing Ho Harrigan or Dr. Mac, or Dav Crockett on to a screen, for thes characters only exist at present a words on a script, as wavy lines o a plastic record.

The moments of terror or tender ness, which sound so real from you loudspeaker, have all been create by players clutching scripts an watching the producer—so they ca sigh or die in step with syntheti sound effects!

To see this going on would rui the illusion for all time.

Neither could you enjoy watchin the newsreader for a quarter-hou as he sits in his stuffy little studi ploughing through his pile of co sheets.

Nor, yet again, your favorite di jockey, surrounded by records, as trays, cups of tea—and a book read while the records are playin

Television is a new and different form of entertainment which must appeal alike to the eye and ear. Its programs must be planned and created in much the same way as a motion picture which you see in the local theatre.

From this position, the producer views the signal available from the separate cameras and selects the most appropriate view. She (or he) can also introduce scenes by remote control from the telecine equipment, which will have been set up ready in another room. Individual operators keep check on the adjustment of each camera or signal channel.

MUST LOOK THE PART

The characters have to look li the people they're supposed to b they have to do the things they' supposed to be doing; and in t right kind of environment. Th have to memorise lines, not just re them from a script.

Costumes, make-up, scenery a lengthy rehearsals become the ord of the day. In fact, the producti of television programs demands the facilities and complications of big movie centre — but operati more smoothly, more efficiently.

Several studios are needed maintain a flow of program materi studios large enough to accommoda actors and scenery, microphon television cameras, film camer perhaps; studios which are ful soundproofed, equipped with kinds of lights, air-conditioned a fronted by sound and vision contr rooms.

A television studio is a pla where workmen have to be constan ly on the job, building, painting, d mantling, storing and moving se according to the day's requirement

acilities must be provided to tele-
e complete films or insert into
dio production, scenes which have
viously been photographed on
vie cameras.
pecial effects have to be achieved
ctronically—fades, laps, dissolves,
eo inserts and all the other tricks
ich have become part of the tele-
on art.
aptions must be added, adverts
in, scenes from one source inte-
ted with scenes from somewhere
—all with the one aim of achiev-
smooth presentation to the view-
audience.
he cost of all this is enormous.
t is why commercial television
Australia has gravitated largely
the hands of large groups which,
ectively, can outlay the necessary
ital.
ut perhaps you're wondering
t the inside of a television sta-
looks like—or rather the inside
its studio block. The station
per, the transmitter and aerial,
probably miles away on high
nd, whence they can best radiate
VHF signal into your home.

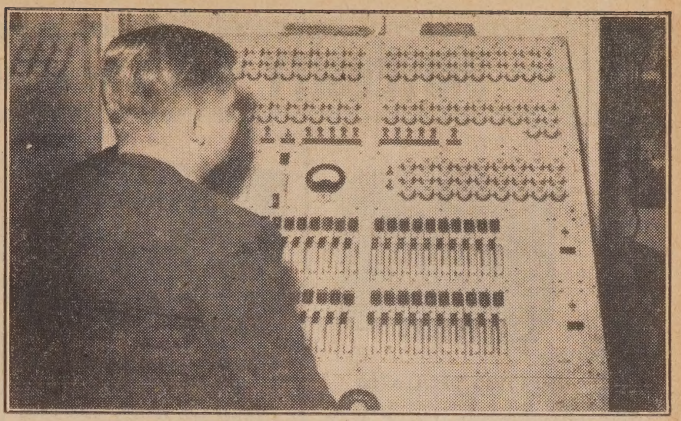
TAIN'S LATEST

ave a look, then, at the photo-
hs and the plan of Britain's new
i only) commercial TV station.
he ground floor is occupied by
ving Rooms, Camera Control
ms for Studios 3 and 4, Lighting
trol Rooms, Sound Locks, Tech-
l Stores and Workshops.
n the first floor are the Vision,
d and Camera Control Rooms
studio 1, a similar set of rooms for
io 2, together with Vision and
d Control Rooms for Studio 3
Vision and Sound Control Rooms
Studio 4. Three Announcers'
ns also are on this floor.
e second floor is occupied (be-
n Studios 1 and 2) by the Master
pment Room, a Lighting Control
n and a Lighting Equipment
n, both the latter being for the
te control of the lighting in
ios 1 and 2.
order to explain the processes
which a television program
nating from the studio floor
es the transmitter at Croydon,
proposed to select one of the
studios and to follow the pro-
along a typical route.
t us imagine that our program is
nating from Studio 1 on the
nd floor.

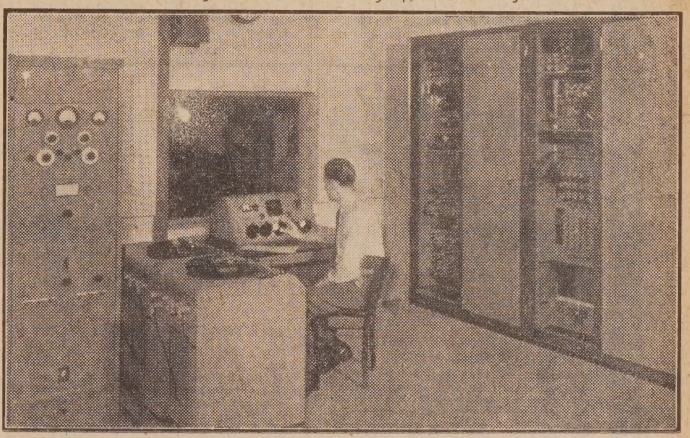
DIO SET-UP

e studio floor will have several
built on it, which together will
sed for various scenes in one
am, or perhaps for several pro-
s. The technical equipment in
studio includes three television
ras, microphones and lighting
ment.
ile these are adjusted in the
by operators, the latter do so
on instructions, via headphones
the Control Rooms overlooking
studio.
e three cameras on the studio
are always "alive", viewing the
from three different angles and
lating it into complex electrical
ises.
se three separate sets of signals
d, over cables, to the CAMERA
TROL ROOM, where they are
cted to individual Camera Con-
nits, each manned by an opera-

ve each Camera Control Unit
wo cathode-ray tubes and con-
on one of these tubes the wave-



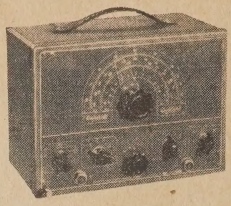
All lighting in any given studio is controlled from consoles like this one, on instructions from the producer. An important facility is that of presetting particular lighting arrangements or "memorising" previous settings.



Portion of a control room, with turntables for introducing special sound effects. Through the glass window an operator can see into the telecine room beyond. From here, filmed sequences are made available which it would be impossible to create in the studio.

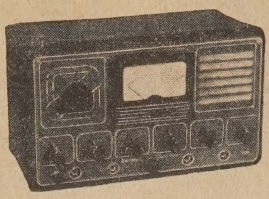
The master control room through which all signals are routed to the transmitter. The master controller will indicate the exact moment to begin a program from the studios. He will introduce outside broadcasts, cut in advertising matter and generally merge the material available into a smooth, properly timed daily presentation.

UNIVERSITY service aids . . .



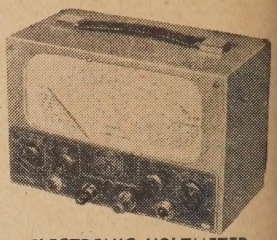
IMPROVED OSCILLATOR

Model YOA. Gives dynamic on-the-beam performance, and new Vernier or fast drive dial makes for quicker and easier tuning. Has improved attenuation system and the dial is calibrated in spot frequencies for quick tuning over the main alignment points merely by changing the switch. Has continuous coverage from 30 megacycles to 150 KC in overlapping bands. Write for free illustrated leaflet.



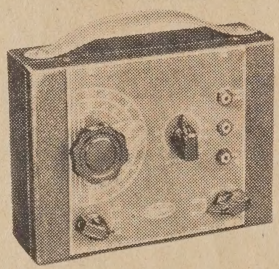
SIGNAL TRACER and V.T.V.M. —MODEL AST

Here is a Sensitive Signal Tracer with a Vacuum Tube Voltmeter which brings fault finding in service work to a stage where faults can be quickly located and analysed. Brief specifications are: Power. 240 volts, 40 to 60 cycles. VTVM: 0/5, 0/25, 0/100, 0/500. Volts AC and DC. The signal tracer covers from 175 kilocycles to 18 megacycles. A leaflet is available on request.



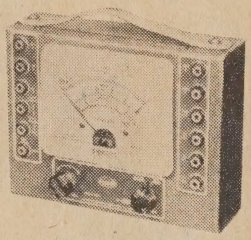
ELECTRONIC VOLTMETER —MODEL TVR-EV

This smartly styled University Electronic Voltmeter is designed for immediate use in Radio, TV, FM and Electronics. It offers many new outstanding features, and is a basic measuring instrument for every branch of electronics. It offers accurate measurement of DC voltages, AC voltages, very wide resistance ranges and RF volts. Write for free leaflet.



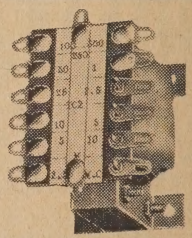
OSCILLATOR—MODEL OK1

Available as complete kit of parts, with all constructional details clearly set out, or assembled. Covers all fundamental frequencies in the average receiver. Will give years of sterling service. Standard batteries are used, and each O.K.1. is supplied complete with Instruction Book. A free illustrated leaflet will be mailed on request.



MULTIMETER—MODEL MK1

Has a wide range of AC and DC voltages up to 1000 volts and measures current in the range of 1, 10, 50 and 250 milliamperes, and resistance readings up 100,000 ohms. Has U4 square meter with clear Multi-Scale. Supplied either as a kit or assembled. Assembly from the kit of parts is easy, wiring instructions and constructional details are given and photos and diagrams make the job easy. Write for details.



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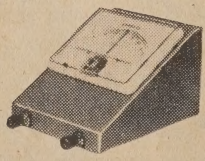
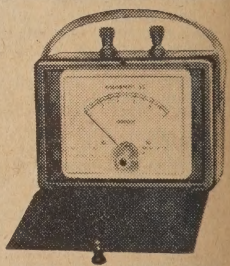


METER STANDS

Model B20

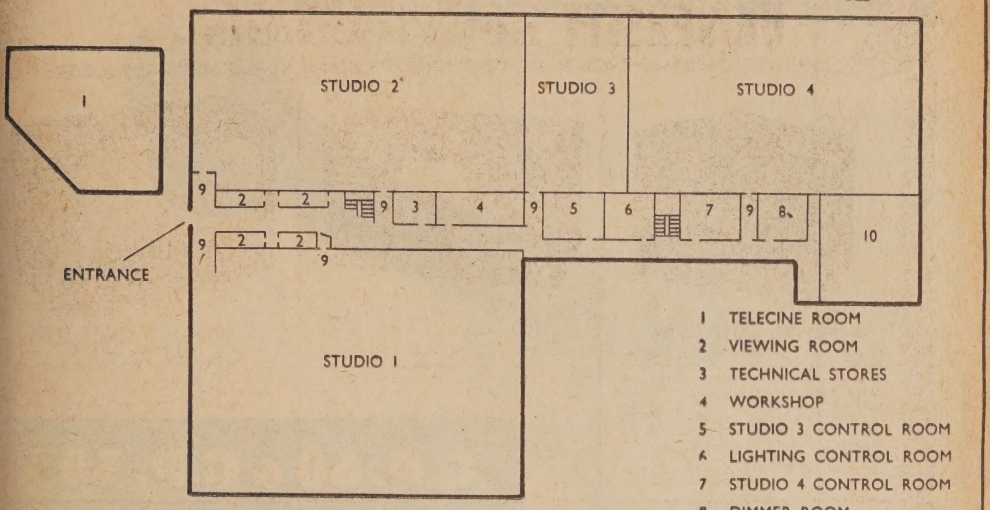
Illustrated herewith is the University Model W4 meter, mounted in a sloping front bench stand and fitted with terminals with non-removable tops. This stand is of steel finished in grey brocade and is ideally suited for testing laboratories, experimental setups, technical colleges, schools and the like. The stand is ready stamped and drilled to accommodate either the W4, U4 or R4 meter. Model B20 stand can be supplied with or without meter and can be used as either a 60 degree sloping front stand or 30 degree sloping front stand.



PORTABLE METER CASE MODEL B21

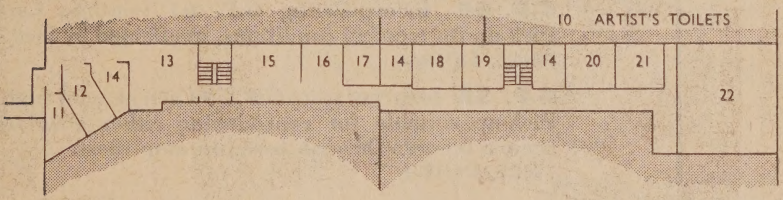
The case illustrated here is of hard moulded rubber, yet with sufficient resiliency to stand shocks and be unbreakable. It is supplied ready drilled to accommodate Models U4, W4 or R4 meter and is supplied with two terminals and carrying strap handle. A flap lid is fitted to the case so that the meter can be protected when not in use. Because of its insulating qualities this can be used for relatively high voltage equipment and provides a convenient method of employing portable meters for any industrial or electrical uses. Any range of meter can be fitted.

WEMBLEY TELEVISION STUDIO CENTRE

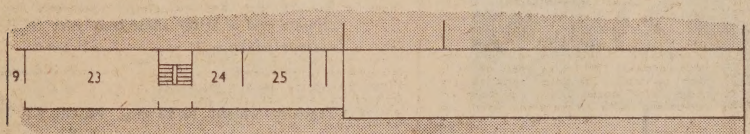


1 TELECINE ROOM
2 VIEWING ROOM
3 TECHNICAL STORES
4 WORKSHOP
5 STUDIO 3 CONTROL ROOM
6 LIGHTING CONTROL ROOM
7 STUDIO 4 CONTROL ROOM
8 DIMMER ROOM
9 SOUND LOCK
10 ARTIST'S TOILETS

GROUND FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

11	STUDIO 1 SOUND CONTROL	16	STUDIO 2 VISION CONTROL	21	STUDIO 4 SOUND CONTROL
12	" 1 VISION "	17	" 2 SOUND "	22	TECHNICIANS TOILETS
13	" 1 CAMERA "	18	" 3 VISION "	23	MASTER EQUIPMENT ROOM
14	ANNOUNCERS ROOM	19	" 3 SOUND "	24	LIGHTING CONTROL ROOM
15	STUDIO 2 CAMERA CONTROL	20	" 4 VISION "	25	LIGHTING EQUIPMENT ROOM

of the camera signal appears, the other reproduces an actual re of what the camera is "see-

e operator maintains constant h over both of these, adjusting hanges of lighting and thus en- g a suitable picture for trans- on. In this way the three ras on the studio floor are con- d for picture quality.

e VISION CONTROL ROOM ooks the studio, and from here rogram is produced. The pro- sits at the control desk be- the Vision Mixer on the right the Studio Lighting Control neer on the left.

e signals from the cameras on tudio floor are also fed to the Vision Control Room, where they appear on Picture Monitors, which are somewhat similar in appearance to home television receivers.

The producer, therefore, has, on three of the monitors in front of him, pictures showing exactly what their related cameras are "seeing". He can, therefore, choose the picture most suitable to his purpose at any given moment, and cause it to be routed on its way to the transmitter.

The actual switching and fading is done by the Vision Mixer, who by push-button selects the picture chosen by the producer and passes it to the MASTER EQUIPMENT ROOM, its next destination, en route to the transmitter.

The Vision Mixer can also remotely control the telecine projectors (which are installed in the Telecine Room on the ground floor) when filmed inserts are required in the program.

The Lighting Control Engineer, on the left of the producer, is in touch, by a telephonic talk-back system, with his switchboard on the second floor.

The SOUND CONTROL ROOM is separated from the Vision Control Room by a double glass window, but also overlooks the studio. The Sound Mixer faces a console upon which are mounted faders, which control the outputs of the various microphones used in the studio to pick up the music or the voices of the artists.

(Continued on Page 9)

2 NEW acos PICK-UPS

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G.P. 60 Incorporating G.P. 61 Ceramic Cartridge. The Pick-up for tropical conditions, unaffected by heat or humidity. **PRICE, £6/16/-**

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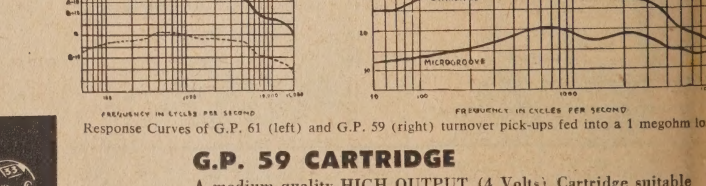
- Easily Replaceable Styli

Tracking weight, 10/12 gms. **PRICE, £3/19/6**



Response Curves of G.P. 61 (left) and G.P. 59 (right) turnover pick-ups fed into a 1 megohm lo

G.P. 59 CARTRIDGE

A medium quality HIGH OUTPUT (4 Volts) Cartridge suitable for reproducing standard and microgroove records through *low gain amplifiers* as those used in small record players and some radios (not comparable with HGP 37 or HGP 39).

SALIENT FEATURES:

- High Output and Smooth Response
- Easily Replaceable Styli
- Low Stylus Pressure
- Hermetically Sealed

Tracking weight, 10/12 gms. **PRICE, 43/-**

Sole Agents in Australia

AMPLION (A'SIA) PTY. LTD.

88 Parramatta Road, Camperdown, Sydney, N.S.W. Phone LA 6124

TV STATION

(Continued from page 7)

microphone can be faded in or t will.

e Sound Mixer is responsible for taining the continuity of sound the studio to match the pro-'s pictures in the Vision Con-Room.

is also responsible for the tech- aspect of the interpolation of uncements emanating from the uncer's Booth and for the in-ction of recorded music or l into the program as required. have hitherto been accustomed eing the announcer in front of amera, but it has been felt that spoken word alone is just as ive and, therefore, in the case rograms emanating from the bley Television Studios, the an-cer will not usually be seen on creen.

ON CHANNEL

this means, the Vision Channel ailable for more profitable use. Wembley the announcer is seat- a cubicle alongside the Vision ol Room, with a full view of Control Room and studio opera-

fore following the vision and l program to its next destina- the Master Equipment Room on econd floor, brief mention must ade of two further links in the :—

e LIGHTING CONTROL M, with its associated equipment is on the second floor. From the studio lighting is remotely olled, upon instructions from ighting Control Engineer in the n Control Room.

already mentioned, the TELE- ROOM at Wembley is situated e ground floor but, as its func-s more closely allied to the first second floor operations, it is oned here.

e telecine equipment is an indis-ble aid to program production; xample, the producer may re- a sequence, such as that of a at speed, which would be im-le to reproduce in the studio. ch cases, a filmed sequence is

ED PICTURES

telecine equipment converts lm pictures into electrical im-, which are fed in at the cor-oint of proceeoings in place of amera signals. It is also used to luce captions and advertising ncements, usually from slides all drawings. This equipment e remotely controlled by the Mixer or Master Control.

have followed the program the studio floor through the ol Rooms, and it might well that it could now be routed to the transmitter. For various cal reasons, however, this is , and the signals have first to the Master Equipment (MAS-CONTROL) Room.

nay well be that our producer es scenes from the outside in his program. These, as we een, can be brought in on film, live transmission is required ust be handled by the Remote st (OB) Department.

signals from there are routed e Master Equipment Room at ley by microwave link or cable, and the producer relies upon the Master Controller to supply him with the OB pictures required.

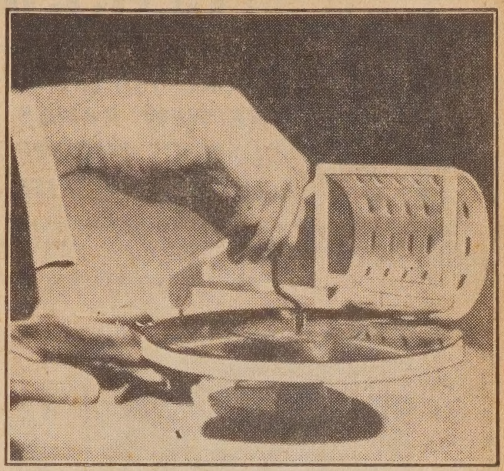
The prime function of the Master Controller is to select the outputs of the various studios and Remote Telecast Units to build up a complete day's program, inserting the filmed advertising announcements to a precise time schedule.

From the Wembley Master Equipment Room, the signals are passed to Associated-Rediffusion's Headquarters at Television House, in Kingsway (formerly Adastral House), thence, via the Museum telephone exchange, to the Independent Television Authority's Croydon transmitter. From here they are radiated all over the Greater London area.

The foregoing is really an over-simplification of what is an enormously complex technical process. Of necessity, much has been omitted, but it is hoped that enough has been said to establish the main pattern of events.

A PHONOGRAPH FOR FIFTY CENTS

In these days of modern, high-fidelity record players, the old-fashioned spring phonograph seems a very primitive device. But RCA engineers have dug even deeper into the past to resurrect a hand-driven model!



RCA's hand-driven phonograph is the product of political expediency, which called for some method of getting the Western viewpoint into "Iron Curtain" countries and jungle trouble spots.

Leaflets carried in gas-filled balloons have been used but have limited coverage. Radio, too, is a useful medium but it can easily be jammed by those who don't see eye to eye with the Western world.

Accordingly, RCA engineers came up with a hand-powered phonograph, which it claims can be made for 50 cents or less and therefore delivered gratis to millions of potential listeners behind the Iron Curtain and elsewhere.

Its message cannot be "jammed" and the very novelty of the device would ensure it being used. Even President Eisenhower couldn't resist playing a record "for the fun of it", according to RCA's chief, General Sarnoff.

ONLY FOUR PARTS

There are just four parts in the gadget, which can be assembled in a few moments by almost anybody: A metal handle, a base, a turntable and a tone arm of unbreakable plastic.

The whole lot weighs seven ounces and packs into a cardboard carton measuring some eight by eight by four inches.

It can be dropped from planes just like ordinary propaganda leaflets and will not suffer damage when it lands.

The records are 7in unbreakable vinylite discs, and designed for operation at a nominal 78 revs per minute—a conventional speed which happens to be a convenient one for hand cranking.

Special foreign-language discs had already been prepared for use in Burma, Laos, Thailand, Vietnam and elsewhere, all aimed at describing the freedom which is part of the American way of life.

MANUFACTURING RIGHTS

RCA has offered manufacturing rights gratis to the US Government and is also willing to make details available to other interested companies.

After its first public demonstration, the little phonograph prompted enquiries from a variety of sources not connected with politics. Educational groups saw its immediate possibility, one medical school considering its possible use to teach hygiene to backward Indian tribes.

Religious groups are impressed for similar reasons.

A museum is considering the possibility of using the device as a self-guide for tourists, discs being produced in all necessary languages.

Last but not least, a sportsman has described the gadget as "the answer to a hunter's prayer". He wanted RCA forthwith to supply him with a phonograph and a record imitating duck calls!

MANUFACTURERS OF COMMERCIAL RADIO RECEIVERS FOR 14 YEARS

CLASSIC RADIO

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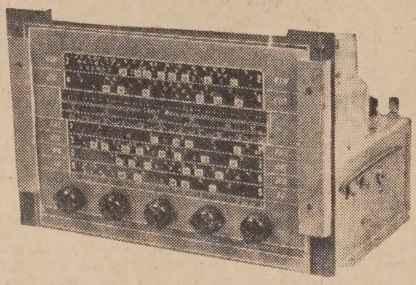
HI. FI.

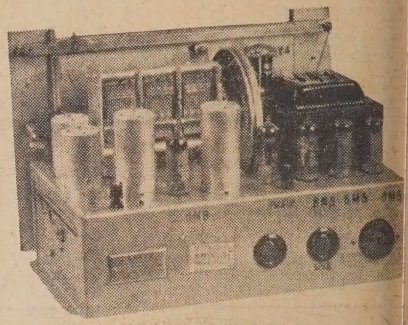
BEFORE PURCHASING YOUR RADIO SEE AND HEA THE NEW RANGE OF HIGH FIDELITY CHASSIS B CLASSIC INCORPORATING THE MULLARD 5/1 AUDIO AMPLIFIER CIRCUIT.

Compare these new features of our Hi-Fi nine valve D.W. radiogram chassis with dual triconed speakers and separate bass and treble boost.

Priced at £39/15/- F.O.R.

Frequency Response 40 to 13,000 Cycles — Max. Output 10 Watts.





NEW ● Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Perma tuned iron cored coils and intermediates giving excellent interstate reception and a short wav range of 12,000 miles. All valves used are the new Philips nine pin innoval series.

NEW ● Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate ba and treble controls giving + or — 15db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., com bined with push-pull output with inverse feed-back gives you really high fidelity reproductio from your radio or favorite recordings.

NEW ● Dual speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) wi matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycl Speakers are mounted coaxially making only one 11in mounting hole necessary. If required the new Magnavox high fidelity twin coned speaker can be supplied.

NEW ● Large calibrated edge-lit dial in perspex (11in x 7in) with main stations of each State in promine type. Dial fitted with counterweight drive giving smooth tuning. Indicator lights are fitted showi which band is in operation. Dial can be supplied in cream or brown with matching knobs a escutcheon to suit blond or walnut finished cabinets.

NEW ● Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on intersta overseas and country stations.

All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chass also pick-up terminals and three-pin outlet for gramo. motor.
Power switch is fitted to volume control, radiogram switch combined with wave change switch. Audio end of set c be used with T.V. receiver if required.

ALL CHASSIS GUARANTEED FOR A PERIOD OF 6 MONTHS

A New 10-Valve Dual-Wave Radiogram Chassis

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£42/15/- F.O.R.

Write for full specifications

RECORD PLAYERS AND CHANGERS

We have a complete range of 3-speed record playing equipment, including Dual, Collaro or Garrard Players, wit turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new Dual 3-speed change that will play 7, 10 or 12in record intermixed. All changers have turn-over Crystal pick-ups.

CLASSIC RADIO

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RAAF MAY GET NEW JET FIGHTER

ccording to a recent announcement, the Royal Aus-lian Air Force may be equipped with the F-104A tarfighter", claimed to be the fastest combat craft in the world. Details of the new fighter are given below.

ING on "razor-blade" wings, the F-104A is a lay-and-night fighter powered by the new General ric J-79 engine, one of the world's most powerful

The Starfighter's maximum speed remains a secret, Lockheed officials say that its speed in climb is to its speed in straight-and-level flight. Opera- altitude is simply quoted as "the upper strato- e". It has been described by General Nathan F. ing, US Air Force Chief of Staff, as "the most nced plane of its type ever developed".

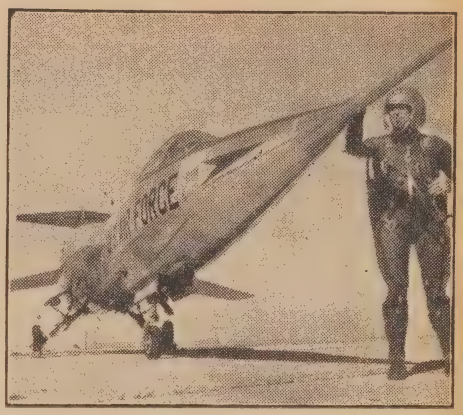
Showing for the first time its heretofore secret con- ation, the lance-like Starfighter measures 54ft 9in 9 metres) from nose to tail. Wings, thin and ght, extend only 7½ft (2.28 metres) from the fuse- and they taper to a squared tip.

The wing's leading edge is so sharp that a felt ring is used to protect ground crewmen when the is not flying.

Foremost features of the new air weapon include:

1) The most powerful jet engine, thrust-per-pound, yet developed.
2) The first downward ejection system for a pro-duction jet fighter.
3) A T-shaped "flying tail".

Optimum speed and manoeuvrability were given ighter by trimming out all possible airframe weight striving for simplicity rather than complexity of operation. Weighing less than any operational jet com-bat plane, the F-104A is a lightweight fighter — in everything except striking power, according to C. L. Johnson, chief engineer of Lockheed's California Divi-sion.



Showing, above, a front view of the new "Starfighter" and, be'ow, its unusual shape and short, stubby wings. Unconfirmed reports set its top speed as from 1400 to 1500 mph, or twice the speed of sound.

"This aeroplane packs more punch per pound than any jet fighter ever built," Johnson disclosed.

The T-shaped empennage is called a "flying tail" because the entire surface of the horizontal stabiliser moves. There is no elevator on the thin stabiliser, which is located almost at the top of a high, swept-back ver-tical fin.

At top speed the Starfighter's new J-79 turbojet with afterburner develops half of its thrust as a ramjet— in which compression of air entering the engine is in-creased by the sheer force of the aeroplane's very high speed.

A. W. (Tony) LeVier, director of Lockheed's flying operations and first to fly the prototype XF-104, called it "the most exciting aeroplane in America today". (The XF-104, first flown in February, 1954, has made more than 300 flights. It is powered by a Curtiss-Wright J-65 turbojet with afterburner.

SCHEDULED FOR EARLY DELIVERY

Described by General Twining as "the fastest and highest-flying fighter anywhere in the sky", the first production model F-104As are scheduled for delivery to tactical units in the near future. Meanwhile early production models are undergoing exhaustive tests.

"With all its power and performance, this 'bird' should be too hot to handle," Herman R. Salmon, Lock-heed chief engineering test pilot, recounted. "Far from it, though. It is smooth to control and it responds with precision and speed".

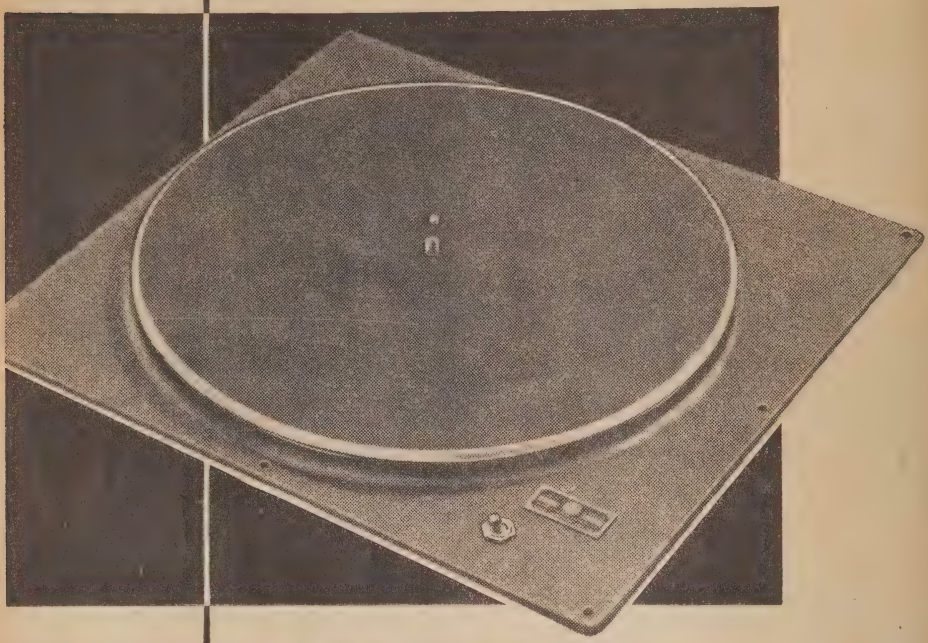
Newest addition to Lockheed's 12-year-old jet family which started in 1944 with the US Air Force's first operational jet, the F-80 Shooting Star, the F-104A embraces a Lockheed philosophy of "design flexibility".

An example of the design simplicity applied to the Starfighter is a new "integrated electronics system" devised by Lockheed. By repackaging the various com-munication and navigation components, it was found that they could be installed as a series of inter-connect-ing but self-sustaining units.

The separate units can be plugged quickly in place, or unplugged, to provide the aeroplane with only the electronics equipment actually needed for a specific mission. Unnecessary weight is thus eliminated.

(Continued on Page 123)

You asked for it..



the T25 3-SPEED TURNTABLE

In response to the interest shown by the HI-FI enthusiasts we have decided to make another production run of this celebrated. model. Limited numbers only will be available, so do not delay in placing your order.

The Synchronous motor, rubber cushioned, and with ample reserve power, gives constant speed at all times, and ensures that "wow", "flutter" and "rumble" are at a minimum.

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SOUND QUALITY

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BOFFIN SPORT—SHOOTING NUCLEI

ext time you take a pot-shot at a rabbit on the horizon, you can e comforted by the thought that your chances of hitting the target are uch better than those of a scientist who aims to hit the nucleus of an om. His target also is surrounded by lots of free space — and he can't even see it.

IEN a scientist "shoots" at a nucleus, his object is either to k bits off it or add bits to it. er way, the result can be ex-ely interesting.

ccess in hitting the target, it t be thought, would depend in way upon the skill of the scien-is a marksman. But success is more akin to chance, and from rience it is known that the ng of hits depends upon the tion of suitable missiles, upon speed and upon a copious sup-f "ammunition".

e ammunition at the disposal of cientist is of several sorts. The kind to be used were the par- shot out by radium.

ese are called "alpha" particles. are thrown out with very high is and they carry a double posi-electric charge.

URAL RADIOACTIVITY

nen radium is used to bombard atoms of another element the tist does not have any say in peed of the particles. And un-those speeds are high there is chance of hitting the nucleus this latter is also positively ged and thus tends to repel lpha particles!

general the speeds of particles radioactive substances are too for consistent results.

e real need, for success, is to an intense stream of high speed cles—a sort of rapid, high speed ine-gun fire.

e second type of ammunition discovered by passing an elec-lischarge through hydrogen gas, hen applying very strong elec-ields to give the resultant par- high velocity.

ese are the protons that carry le positive electric charge. They ess strongly repelled by the us than are the alpha particles. third type was discovered the element beryllium was arded by alpha particles. Un-ed particles are produced neutrons. They are not de-d by the nucleus of an atom or ie electrons and hence would apable of scoring hits even if speeds are not very high.

at happens when atoms are arded by any of these "atomic es" depends upon the element arded and upon the missile

or example, iron is bombarded neutrons, the nucleus of the om absorbs a neutron and in ing forms an isotope of iron becomes radioactive and gives amma rays. Such radioactive es give out their energy at a that can be measured and is characteristic of each

American scientist has shown another type of change. When a thin film of mercury is bombarded with very high speed "atomic missiles" the metal gold is produced. The mercury metal loses a proton and is thus converted into a new element—gold.

The nucleus of an atom has been likened to a number of spheres held together by springs. For each element it is supposed that there is a sort of pattern or arrangement to which the spheres adjust themselves.

If a spring breaks—as for example as a result of bombardment by "atomic missiles" — the stable arrangement of the nucleus is upset. One sphere may then be thrown out with considerable force and the remainder settle to a new pattern.

If, in this new arrangement, one of the springs becomes overstretched, stability may require that another sphere be ejected.

In naturally radioactive atoms the unstable condition already exists, and the nucleus may have to pass through several stages, shooting out spheres during some of them, till eventually it attains a stable pattern.

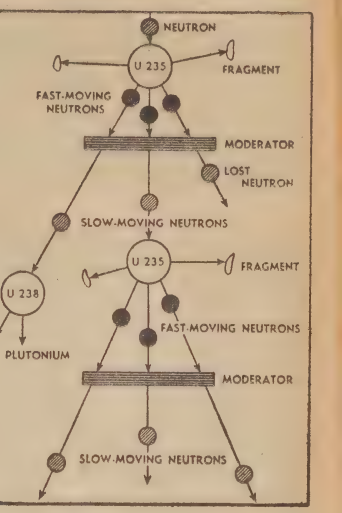


Figure X: Illustrating the use of a moderation to control atomic fission.

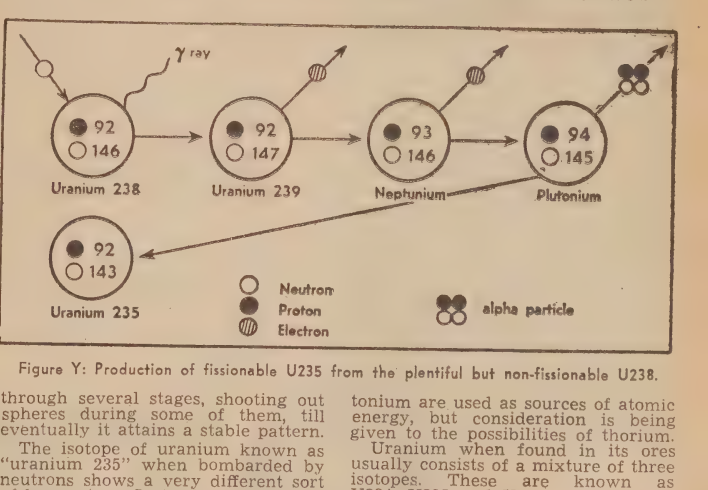


Figure Y: Production of fissionable U235 from the plentiful but non-fissionable U238.

The isotope of uranium known as "uranium 235" when bombarded by neutrons shows a very different sort of happening. Instead of one or two spheres being thrown out as a means of attaining stability, the whole nucleus gives way, splitting into two very nearly equal parts.

At the same time neutrons are produced and these, on colliding with nuclei of other uranium atoms, cause further breaking down to occur.

This is the smashing process which is called "nuclear fission" and it results in enormous quantities of heat becoming available, which if controlled, can be converted into other forms of useful energy, but if not controlled produces catastrophic explosion.

At present uranium 235 and plutonium are used as sources of atomic energy, but consideration is being given to the possibilities of thorium.

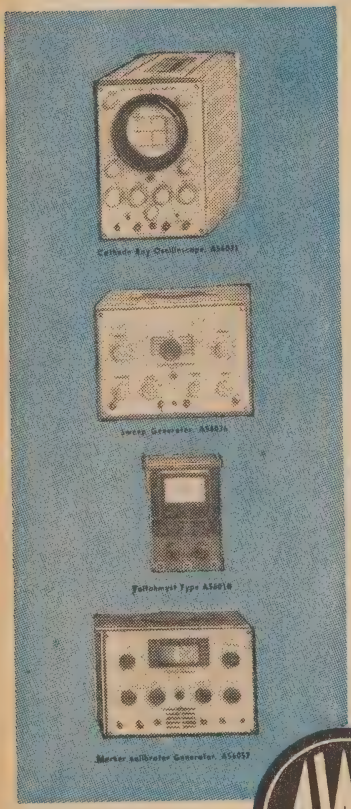
Uranium when found in its ores usually consists of a mixture of three isotopes. These are known as U234, U235 and U238. The first of these is very rare while U235 is the fissionable one and occurs to the extent of about seven parts in a thousand.

This small amount is not nearly enough to keep the fission process going once it has been started. The neutrons released from the fission of U235 atoms would be absorbed by the overwhelming preponderance of the U238 atoms. Hence some attempt must be made at separating the U235.

It is a long and tedious process. Chemical separation is not possible since the isotopes behave similarly. The usual method adopted is the

(Continued on page 15)

HERE'S HOW YOU CAN PROVIDE EFFICIENT TV SERVICING ECONOMICALLY



YOUR DEPOT REQUIRES THESE INSTRUMENTS FOR EACH 2 MEN:-

A.W.A. Cathode Ray Oscilloscope. A56031
A.W.A. Sweep Generator. A56036
A.W.A. Marker calibrator Generator. A56057

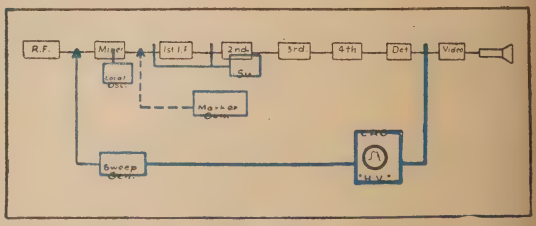
and for each Depot man:—

A.W.A. Voltohmyst Vacuum Tube Meter. A56010

Your Field men each require:—

A.W.A. Voltohmyst Vacuum tube meter, plus valve and kinescope spares, controls, resistors, capacitors and the like.

Schematic of a method of using these instruments for checking a receiver response curve.



AWA

TV SERVICE INSTRUMENT

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AUSTRALIA'S NATIONAL WIRELESS ORGANISATION

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167 Queen St., Melbourne. MU9161

SHOOTING NUCLEI

(Continued from page 13)

ysical separation which depends on the fact that substances of fferent density diffuse through a e porous partition at different tes.

The difference in density between 35 and U238 is small and this eans that enormous areas of filter e necessary. It has been estimated at in one factory alone, the filter aterial if laid on the ground would ver the whole of Great Britain!

For use in an atomic pile com-te separation of the isotopes is not ways required, and usually an iched material will suffice, that one containing a high proportion U235.

HAT HAPPENS

The diagram X is intended to con- pictorially something of the pro- s going on inside the pile. A utron is shown approaching an m of U235 and causing fission to ur. The two halves into which nucleus is split are roughly ial. These are the nuclei of two v elements and they are radio-ive.

At the same time a few neutrons liberated while a small amount mass is converted into an rmous amount of energy which ears mainly as light and heat.

The neutrons are shot out at very at speed and in order to reduce to a speed that will have the ximum efficiency in producing ther fission, the neutrons are sed to pass through a moderator ch is usually pure graphite.

f pure U235 were used and anged in the correct manner the nber of fissions would build up y rapidly and explosion would ur. But in enriched material e of the neutrons will be lorbed by U238 while some will lost from other causes. There it, however, be sufficient of them to maintain the reaction.

the reaction starts to proceed rapidly the temperature will and this is the signal for the ration of the safety devices. se latter consist of rods of cad-m, whcih, when lowered into the , will absorb neutrons and slow n the reaction.

FUL PRODUCT

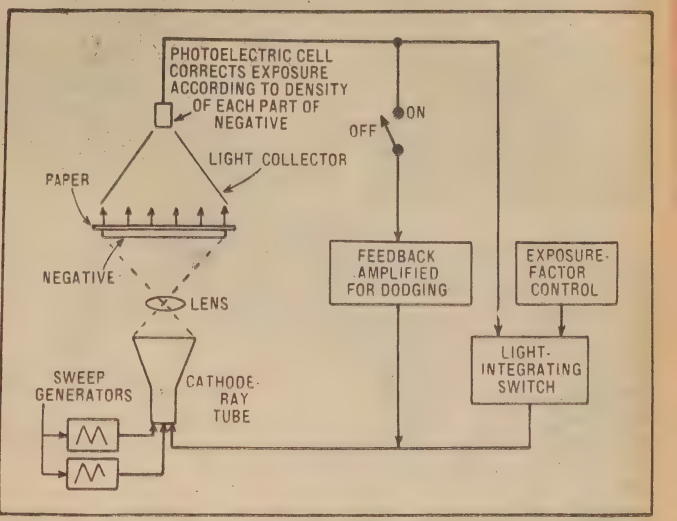
ne absorption of neutrons by 38 is not a complete loss. As in-ted in the figure Y the uranium ransformed first into an isotope uranium, then into neptunium finally into plutonium. This r substance is a completely element and can be separated y easily.

he interest in this process is that tonium is fissionable. If left to it decays into U235. The ial conditions under which the ssionable U238 can be changed fissionable material have been overed and plutonium is now g manufactured in "breeder re-tors" as the factories are aptly d.

he two fission processes using 5 or Pu239 are the only ones g worked at present, and there w a definite prospect that these soon be providing energy for dustrial and domestic uses.

AN ELECTRONIC PHOTO PRINTER

The flying spot scanner tube, originally devised for television purposes, has recently been adapted to solve one of the tricky problems associated with photographic printing.



THE problem, which is as old as photography itself, occurs when important sections of a negative differ greatly in average density.

Though the range of "tones" may not be beyond the capacity of the negative to record, difficulty immediately arises when a print has to be made on photographic paper.

Since the incident light has to pass twice through the emulsion on a paper print, before it comes back to the viewer's eye, it diminishes as the square of the capacity.

Thus, areas which are in partial shadow in the original scene, and record as such on a negative, appear as near-black on a paper print.

If the printing time is set to suit one portion of the negative, the rest of the picture is either too light or too dark.

Various means have been adopted to overcome the difficulty.

Masks, either cut physically from opaque material, or prepared photographically, have been inserted between the negative and the print to equalise matters.

More simply, the operator may resort to a "dodging" technique, moving his hands into the image area and so cupping his fingers that the effective exposure time is reduced in areas where the negative is least opaque.

The respective processes call for much preparatory work in the one case and a good deal of skill in the other and repeat prints from the one negative may vary quite a lot in quality and balance.

The new method replaces the printing lamp with a flying spot scanning tube, which produces an intense spot of light at a single point on its screen. However, the spot can be deflected in a "raster" pattern so that, in its to-and-fro movement, it illuminates a complete rectangular section of the screen.

The movement of the light spot is focused on to the negative, light passing through the negative directly on to the printing paper, in the case of a contact printer.

In other words, the exposure is made progressively, as the light spot flicks back and forth on the scanner screen.

However, diffused light passing through the paper is collected by a photocell and, by means of a feedback circuit used to control the instantaneous brightness of the scanning spot. When the light picked up by the cell is very weak, it tends to increase the brightness of the spot and vice versa.

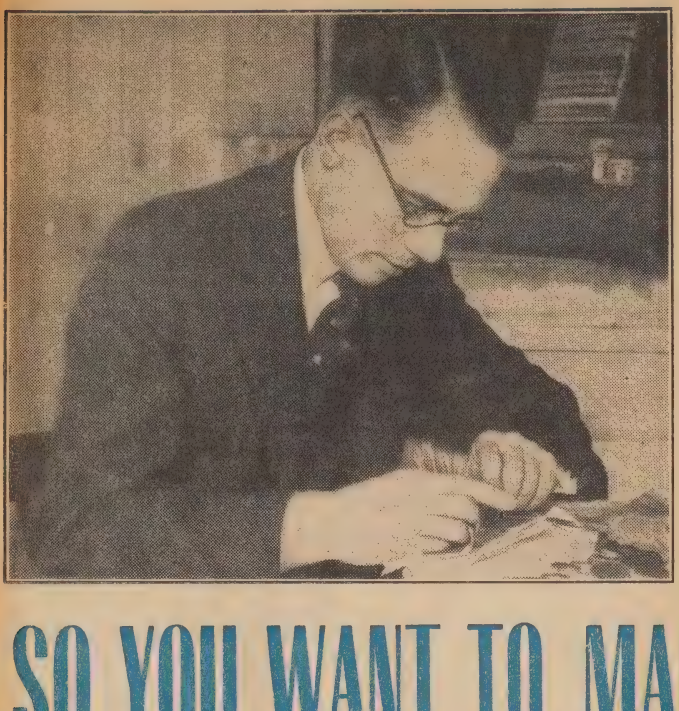
COMPENSATION

It is a relatively simple matter, in the electronic circuitry, to offset the essentially square law characteristic of the printing paper.

It is also possible to set a limit on the "range of tones" which the printer will tolerate, and to set the circuitry so that prints of a uniform average density are produced, irrespective of whether the negatives are dense or thin.

A single setting suffices to compensate for the speed of the printing paper in use.

The printer has special value in the field of aerial photography. Photographs from the air frequently reveal intricate patterns of light and shadow on small areas of the negative. The electronic printer is capable of bringing out many such details which would be lost if the negative were printed by the conventional process. This results, of course, in more reliable interpretration of the aerial photographs.



SO YOU WANT TO MAKE MONEY

There are three ways of making money. You can do it the hard way, like I do. You can ge a job in the Mint and make it legally. Or you can get impatient with your income and mak some money that looks just like the real thing!

by Calvin Walters

MONEY is something we use every day, but we seldom stop to think about the mechanics of it.

When I say "use" I speak for the great majority of ordinary everyday people, for, these days, most of us use money in the true sense of the word. Every penny of it!

By the time every one has had their "cut" out of the wages, there is not much left.

There is the baker, butcher, grocer, hairdresser, tobacconist, publican, chemist, doctor, electric light company, gas company, milkman, tax collector, tram conductor, mercer, milliner, tailor, garage keeper, council, water board and so on.

QUITE A LIST

That's a frightening list to be sure. I have never bothered to write them down before and its staggering. I see now that I can't possibly live on what I get from the boss. The wife will have to do with less, that's all. Or go to work.

It's these sort of circumstances that breed counterfeiters. Most of us could do with a bit extra and a few bad "two bob" pieces wouldn't go astray, provided we could pass them off.

That is the big snag, of course! People don't take kindly to being handed a "dud" coin to pay for something. They just don't understand.

Of course, mind you, it is wonderful just how many honest people will try to pass off a "dud" which they have innocently acquired.

Most people would hesitate to poke their hand into a tram conductor's bag when he wasn't looking and pinch two bob. Yet they would do almost the same thing in a different way by giving him a "dud" in a crowded tram, hoping he wouldn't notice it. Or they would mix it up with a lot of other silver and slap it on the pub counter.

A bad coin burns a hole in the pocket quicker than a good one. There it is but how to get rid of it without losing out is the vital question. Everyone has experienced this some time or another. The answers would make interesting reading.

Now I am firstly to telf you how money is made. That doesn't mean that you can set up a works under the house and start mal coins. To make even spurious is a difficult proposition.

Then I will touch on the var methods used by counterfeiters make their own money.

Many years ago I would have b "run in" for writing such an ar as this. I can assure the authori however, that this story is not outcome of my own experience my humble and poverty-stric home is evidence that I have not cumulated funds, honestly or ot wise!

At one time there were gold c People under the age of about 40 not remember them. There is much purpose therefore in desc ing them. Why we don't have t now, we will leave to econon to try to explain.

Metal coins are either alloys silver or copper but the proce of manufacture are about the s

The place where coins are m is called a MINT. This has not to do with the mint used in sauce. The word is derived from Latin word "moneta" meaning a or money. From this is derived old English word "mynet", or Middle English word "minte" meaning a coin. Originally Latin word was the name of J in whose temple at Rome mo was coined.

A Mint is really a metal smel works allied to a highly special engineering workshop.

In this shop metal is melted, into moulds and the coins stam out by presses in much the s manner as any other metal par made in any other workshop all the world.

WHY SO DIFFERENT

It is the national value and precautions which must be ta which make the job somewhat ferent from the ordinary.

The silver used in a coin mus refined either at the Mint or outside firms until it is 99.9 pc p This is delivered to the mint in form of bars weighing about ounces troy weight.

At the mint the silver is assa to make sure that it is of the quired purity. It is then loc away until ready to be made coins.

Every fraction of metal issued r be accounted for either in scrap or dust.

When ready for coining the s is weighed into crucibles and the quired amount of alloy mixed it. This is usually copper to a

) pc. This is added to render the in less liable to wear in use, be- use the alloy of silver and cop- r is harder than pure silver.

During and after the melting pro- ss, the metal is subjected to con- uous analysis to ensure that the loy is of the required standard.

The molten metal is poured into oulds where it hardens into in- ts.

These ingots then go to the roll- g room where they pass through succession of rollers which reduces e thickness by about one hun- edth of an inch at each roll until e metal is the thickness of the in to be made.

OSE TOLERANCE

The final thickness must be cor- ct to within 1/20,000th of an inch.

The strips of metal are now ready be made into "planchets" or ank discs of metal the size and ickness of the coins to be made.

This process is called "blanking" d is done on a machine which nches the disc out of the strips of etal. This punching leaves a strip metal with holes which is re- elted in the furnace.

The planchets are punched out at e rate of about 150 a minute and ove to a revolving platform in a rnace where they are heated at out 1300 degrees for seven nutes. This anneals the discs ich are quite black from oxide of pper after they leave the furnace.

From the furnace they are tumb- l in a gadget like a washing achine from which they emerge ghly polished.

The blanks then pass on to the lling machine where the coins ss between the face of a revolv- g wheel and a fixed block carry- g a groove. This puts the raised ge around the perimeter of the ink.

The purpose of this raised rim is protect the surface of the finished n from wear and to prepare the inchet for the letters which ap- ar at the edge after passing rough the dies.

The planchets are now individu- y weighed in a special automatic achine which rejects those which e too heavy or too light.

The discs are now ready for riking" or imprinting the design both sides.

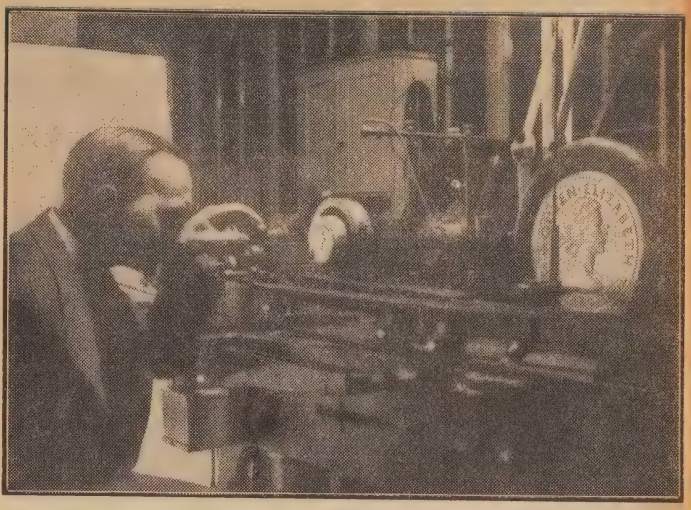
This is done on presses which ike the disc on to hardened steel s with a force of 30 tons at a w.

CIAL DIES

The dies of hardened steel are d in the press, that for one side ng fixed in the base and that for reverse side being held in the er or movable part of the press.

Between the two is a collar which presses the familiar milled edge the coin. The blank is fed on to lower fixed die and, when it is circled by the collar, the upper descends. This action impresses design on both sides of the n and the milled edge at the same e.

Each coin is then weighed on ales so delicate that they will re- t coins which are too light or too avy to within about .17 of a grain.



At the Royal Mint, an automatic machine produces a smaller copy of the basic design for Queen Elizabeth coins. Meticulous care at every step, together with the large reduction factor, produces stamping dies which are near-perfect in detail.

The coins are then tested by "ringing" each one on a steel slab. They then move on travelling belts under the eyes of specially trained inspectors who look out for such defects as nicks, cracks, breaks and embedded foreign substances. The good coins are then passed on to the authority which puts them into circulation.

A word about the dies used to impress the design on the coin will not be amiss.

The designs are first sculptured in wax from six to eight times the size of the finished coin. From this a plaster of paris mould is made which is, of course, a negative of the original.

This is touched up and perfected with engraving tools. A second positive cast is made and again touched up. This is immersed in beeswax to form a base for holding powdered copper which is coated on to the mould.

This coating forms an electrical conducting base and is electrically plated with alternate layers of copper and nickel.

When the required thickness is obtained (about one-sixteenth of an inch) it is removed and you have a replica of the original design, but in metal and free from flaws.

This is placed in a special machine called a Janvier die cutting machine

Some of these might be handy, if you could buy them cheaply. They are notes which have been rejected because of slight printing imperfections. They are carefully checked, then defaced by punching with a pattern of holes.

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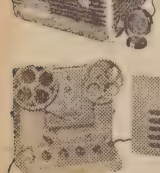
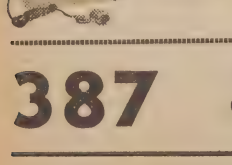
Tape Recorders from £65 & £10 dep





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As Sydney's only tape recorder specialist, we carry a huge range of accessories. **SPECIAL:** Adjustable boom microphone stands, 10' 6" exter height, **£22/15/7.** Microphones from only **£3/19/6.** See the new series Zephyr high-fidelity studio microphone, **£24/1/11.** Reels of from **30/-** for 600'; **£2/14/-** for 1200'. New long-playing tape, 3 recording, **£4/15/-** reel.

WE WILL BUY GOOD USED TAPE RECORDERS . . . TRADE-IN YO PRESENT MODEL.

Selling, servicing and hiring tape recorders is our speciality.

387

MAGNETIC SOUND IN DUSTRIES

GEORGE STREET (OPP. STRAND ARCADE) ON THE FIRST FLO

PHONE BX4440-BX4586

ch, using the replica as a pat-
, cuts the design to a reduced
into the surface of the steel
This is touched up and per-
ed by hand engravers and
ially hardened to withstand the
ing of 50,000 coins before wear-
out.

he manufacture of paper money
printing process from specially
aved plates. There is not enough
e at this stage to describe the
ess and we will reserve this for
ter date.

he only way a counterfeiter can
e money is to make coins from
e low cost base metal. The
ie of silver in a genuine coin
enerally speaking, less than the
value of the coin.

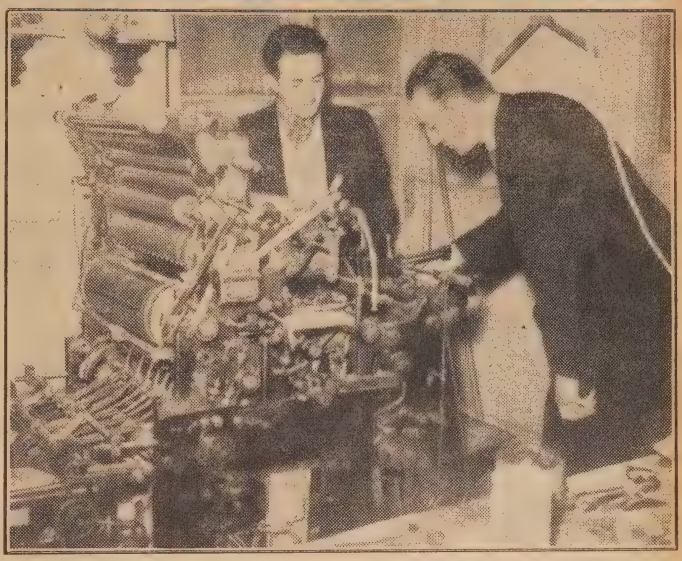
POINT AT ALL

here would not be much point
uying silver to make coins to
g in the same return as the cost
ne silver in the coins.
ou can't make money that way.
the counterfeiter mixes some
r with such metal as tin, lead,
mony and so forth.
metimes silver coins have been
lated by silver plating copper
s. This wears off easily and is
found out.
ne of the difficulties of the
er of coins is the aquisition of
machinery necessary to press
correct design in correct man-
This is far more expensive
the return likely before the
comes knocking at the door.
one time coins were struck by
and had rough, irregular edges.
se were easily imitated because
e was no consistency about the
e. This also led to considerable
aling" of the metal by cutting
craping the edges of the coin.
scraping of thousands of coins
a period would harvest quite a
able amount of silver while the
s were not substantially altered
ppearance.
oday very effective precautions
taken against this. That is why
milled and serrated edges of
ern coins are not put there for
ment. Both the corrugated edge
the milling inside the rim on
faces of the coin are a protec-
against widespread "stealing"
scraping. These also make it
ult to forge a coin without the
er presses for milling.

TING PROCESS

his forces the forger to try to
e coins by taking moulds from
al coins and then casting.
ious coins made in this way
lly have an artificial appear-
and greasy feel, the latter due
he base metal used for manu-
ire.
urious coins can usually be
ted by warming by friction on
coat sleeve and then smelling
coin. It has a peculiar metallic
l. They are usually heavier
the genuine coin, due to lead
nt, or lighter due to aluminium
ent.
Good coins are a bright silver-
in color. Bad coins are often
ll lead-grey. Bad coins have
"ring" when dropped on to
rete floor.
lverting for a moment to the

PROFITABLE — WHILE IT LASTED!



How to make money, French style. This counterfeiters' press in Paris was used to print millions of notes before it was finally located.

practice of paring metal from good coins. There was a case some years ago when the Mexican Government found that, in some mysterious way, many of their gold coins were becoming lighter, although they did not appear to be worn. This led to the loss of thousands of dollars.

AN INSIDE JOB!

It was finally found that the gold had been removed from the INSIDE of the coins and had been replaced with a yellow powder.

Naturally this explained the loss of weight but the method by which the job was accomplished without damaging the surface of the coin was a first-class mystery for some considerable time.

Later it was discovered that a Chinese named Sing Lee had developed an ingenious technique of drilling a tiny hole in the edge of 20-dollar gold pieces, which are comparatively thick, and through it to scrape out the gold from the inside.

RINGING THE CHANGE

After refilling the coin with yellow powder he sealed up the hole with real gold. He would then exchange the lightweight gold pieces for paper money which he would later reconvert into gold pieces at a bank. Thus he would continue the process indefinitely.

Although false silver coins make their appearance on the market from time to time, nobody bothers to counterfeit bronze coins as the value is not high enough.

The greatest danger to the public is from counterfeit paper money.

While it is comparatively easy to detect counterfeit metal coins it is not as easy to detect a well printed note.

The equipment for forging counterfeit notes is much lighter, more readily available and less noisy than that for stamping out metal coins, and some counterfeiters make a "creditable" job of printing notes.

To make their job more difficult, paper money is printed with intricate detail in the design. The fine lines in portrait backgrounds are of a set pattern difficult to copy. Inks are of special composition. Paper is of specified but secret tensile strength. Even the serial numbers are usually printed with a certain spacing between the letters.

ATTENTION TO DETAIL

The engraved plates from which paper money is printed are so perfect in detail, the variation in color and perfection so negligible that the expense of copying is too great for the average counterfeiter. Thus he skimps some detail to save cost and this is usually his undoing.

In short, the difference between the genuine and spurious note is one of quality. Genuine paper money is printed from engraved steel plates while counterfeit money is printed from plates made by some chemical process such as photo line engraving.

Once the main features of one detected spurious note are pointed out it is an easy matter to detect any others like it which come along.

The same remark applies to metal money. So get out your cash, if any, and do a little scrutinising.

"AMATEURS and TECHNICIANS CAN RELY ON

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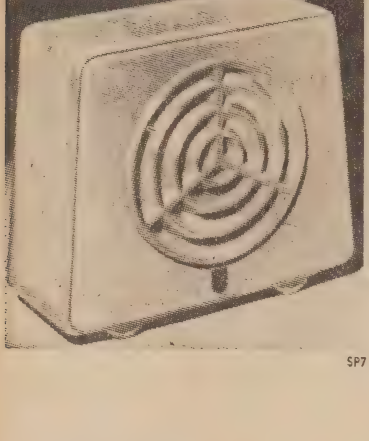
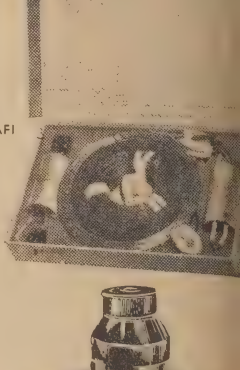
PARTS & ACCESSORIES for SERVICE & RELIABILITY!"



SP7

EXTENSION SPEAKERS

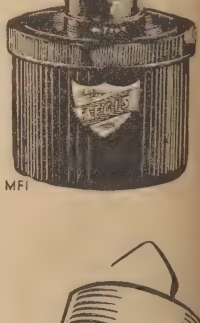
SP7 features plastic cabinet with new Spinner-type front. 11½in wide, 10¼in high (tapered), 4½in deep, with 7in speaker, less transformer. Volume control fitted with special knob in centre of grille. Voice coil outlet, 3.7 ohms. Walnut and natural. **160/9.**
Also available with 8in speaker, **SP8, 167/3.**
SP6 — in round plastic cabinet, 7in circular, 4in deep. Louvred front and rear. Contrasting feet, 6in speaker less transformer (3.7 ohms input impedance). Terminal block supplied. Black, walnut, natural; pastels: blue, green, pink, **109/3.** Also available with 5in speaker, **SP5. 73/6.**



AF1

AF1 AERIAL SYSTEM

All wave (broadcast and short-waves) NOISE REDUCING. Consists of 2 specially matched Aegis transformer units. 50ft twin plastic-covered low impedance lead in wire. 40ft 7/22 copper aerial wire. Completely assembled aerial. Egg insulators, **19/9.** Available separately. AF2, 2/- matched transformers, **130/-.**



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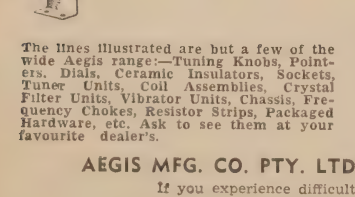
MF1 MAINS FILTER

This splendid line filter eliminates interference from Lifts, Motors, Refrigerators, etc., coming through the electrical mains. **56/-.** MF2 Line Filter—incorp. Extra Inductances. **69/3.**

SP6

M18 SIGNAL MAGNET

(or Loop Aerial) Supersedes ordinary loop aerials. Improved sensitivity and selectivity. FERROXCUBE rod possesses extremely high degree of permeability. Radio frequency waves actually divert from their normal path to pass through this rod. Enables a portable to be used in your car. Full instructions. **24/6.**



M18

M9

AEGIS COILS & INTERMEDIATES

M9 Coils B/C Aerial; M11 Coils B/C osc. 6AN7, 6J8G; M10 Coils B/C R.F. 6BE6, 6AE8, **17/9 Each.** I.F. TRANSFORMER J9 Intermediate 455KC, No. 1; J10 Intermediate 455KC, No. 2, **19/3 Each.**

The lines illustrated are but a few of the wide Aegis range:—Tuning Knobs, Pointers, Dials, Ceramic Insulators, Sockets, Tuner Units, Coil Assemblies, Crystal Filter Units, Vibrator Units, Chassis, Frequency Chokes, Resistor Strips, Packaged Hardware, etc. Ask to see them at your favourite dealer's.

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WEST AUSTRALIA
A. J. Wyle Pty. Ltd
1064 Hay St., Perth

Technical Review

EUROPEAN RECORDING CURVES NOW SIMILAR TO RIAA

According to leaflets forwarded to us by the Editor, and a tearsheet from the latest copy of "The Gramophone", microgroove records bearing several well-known British and European labels will henceforth be recorded with a characteristic which is identical with the familiar RIAA curve.

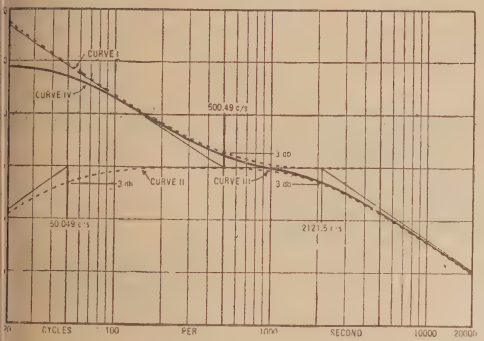


Figure 1: Replay characteristics for microgroove records. It is identical with the RIAA and Philips cuves overleaf and is a further step toward complete uniformity.

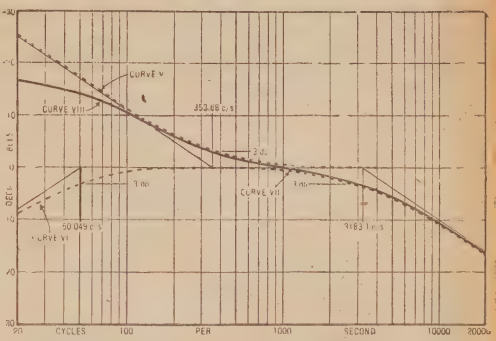


Figure 2: Replay characteristics for coarse groove records. Note that the treble is no longer "flat" but requires 10db cut at 10Kc.

'OARSE groove records will use bass cut and treble pre-emphas of a lesser order, thus departing om the traditional "flat" top sponse.

The following article has been printed from "The Gramophone". or the sake of completeness and mparison, we have added the AA curve from our October, 54, issue and a curve of recom-ended playback conditions from hilips' Phonographische Industrie. arn, The Netherlands.

ONFLICTING PRACTICE

During the past few years, various iters and circuit designers have blished data concerning the fre-ency characteristics which should adopted when replaying disc cords.

Unfortunately, there is little reement between these sources, d consequently a great deal of nfusion exists as to what curves ould be used.

No doubt this is partly due to the pid evolution of the modern mic-

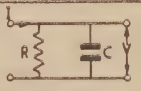
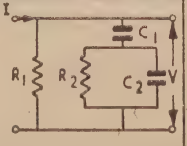
	FREQUENCY RESPONSE	EQUIVALENT NETWORK	TIME CONSTANT (T) IN MICROSECONDS (R IN OHMS C IN MICROFARADS)	
			33⅓ & 45 R.P.M.	78 R.P.M.
SEPARATE NETWORKS	TOP FALL		RC = 75	RC = 50
	BASS RISE		RC = 318	RC = 450
	BASS FALL		RC = 3180 L/R = 3180	RC = 3180 L/R = 3180
COMBINED NETWORK	COMPLETE REPLAY CURVE		C_1R_1 = 2940 C_2R_2 = 81·2 $\frac{R_1}{R_2}$ = 12·4	C_1R_1 = 2780 C_2R_2 = 57·3 $\frac{R_1}{R_2}$ = 7·08

Figure 4: Indicating the derivation of replay characteristics.

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HIGH GRADE METERS

Brand new, high-grade, 2½in square jewelled movement meters. Calibrated 0-20 volt on 5 mA movement, with internal multiplier. In Original packaging. Part No. 4D44. Post Free. Can be converted other ranges— volts, amps, mA. Available a few 0-40v, 4EI.

19/6

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271A (WE, USA) 2.8 Watt Output Triode Class A. Plate 400V. 37.5 MA IH Cathode, Fil. 5V 2A. Plate Res. 2800 ohms. Suitable Hi-Fi Single end or PP Class A Audio Amp 5 Pin UY Base. Post Free. . . . . 17/6 ea.

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CV67 Klystron. Octal Base, with Electrode Cap at Top of Tubular 1 1/8 by 5 in. Glass Tube. Tunable (Slug) Brass Cavity Resonator surrounds Middle of Tube. Port for inserting Pickup Probe. Approx. Frequency 3000 MC. at 100 MW. (all the data we have) Post Free. . . . . 30/- ea.

VS68 (Marconi STV 280/40 Stabilivolt). A Voltage Regulator Gaseous Tube providing a Max. Voltage of 280, with 4 Tappings separated by 70 Volts. Constant Voltage up to 40 MA Drain. English 5-Pin Base. Post Free. . . . . 10/- ea.

NS1 (Marconi STV 280/80 Stabilivolts). Voltage Regulator same as above except Constant Ouput Voltage up to 80 MA. Post Free. . . . . 15/- ea.

LIMITED NUMBERS OF FOLLOWING TYPES, ALL POST FREE.

866A/866 Hw-M Rect. 3500V 250 MA, 40/-. 800 XMTR Triode 65W, 40/-. 802 XMTR Pent 25W, 35/-. 830B XMTR Triode 90W, 40/-. 834 XMTR Triode 75W. 35/-. 211 XMTR Triode 130W, 40/-. 872A Hw-M Rect. 10,000V 1250MA, 40/-. 81 HV-Rect. 700V 85MA, 20/-. 367 FW-Rect 25V 6 Amp, 30/-. AV11 Rect. 12,500V 200 MA, 30/-. GE-FP54 Pliotron, 35/-

We cannot enter into correspondence regarding tech. data on these new tubes—the price is too low to justify the time spent.

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All Post Free.

Egg Insulators (porcelain)	6/- doz.
Electric Jug Spirals (1000 watt)	1/- ea.
Quarter Meg Volume Controls (midget)	2/6 ea.
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One Meg Volume Controls (With Switch)	5/- ea.
Gramo Needle Cups (bakelite)	1/- pr.
Co-Axial Line Spacers (Polyetnylene)	3/- doz.
Morse Keys (PMG type) (plate contacts)	2/6 ea.
Oak Switches (1 bank 2 pole 6 pos)	5/- ea.
Oak Switches (1 bank 2 pole 4 pos)	5/- ea.
Oak Switches (2 bank 3 pole 4 pos)	7/6 ea.
RCS TB42 Class A Audio Transformers	10/6 ea.
RCS TB43 Push-Pull Audio Transformers	10/6 ea.
RCS TA4 Audio Coupling Chokes	10/6 ea.
Gramophone Needles (Columbia Superhe)	5/- (1000)
Crystal Detector. (Dr. Cecil crystal with crystal holder and catwhisker)	2/- ea.
Speakers (Magnavox permag 8P2, 8 inch) inc. Tran.	37/- ea.
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7in x 5in x 4½in deep	Part No 4D3	1
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We supply the parts, but cannot enter into any technica correspondence

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EVERYTHING FOR THE RADIO AND ELECTRICAL EXPERIMENTER

oove record, the optimum re-
ling characteristics of which
e gradually changed in accord-
e with the enormous improve-
ts which have taken place in
mechanical design of pick-ups.
his improved pickup design has
made it possible to modify the
rding characteristic of the 78
disc, so that a very appreciable
ction in surface noise can be
ined, while still maintaining a
e frequency range.
ne recording characteristics used
the EMI Record Division have
stabilised and, since no change
ontemplated in the future, so
as can be foreseen, the informa-
given here can be used with
plete confidence.
ne replay characteristic for mic-
oove recordings is the sum of
5 microsecond top fall, a 318
osecond bass rise, and a 3180
osecond bass fall (Fig. 1).

ARSE GROOVES

ne replay characteristic for
se groove recordings is the sum
50 microsecond top fall, a 450
osecond bass rise, and a 3180
osecond bass fall. (Fig. 2.)
ne correct replay curve can be
ined electrically by cascading
rate circuits each providing the
vidual time constants given in
definition (Fig. 3) providing that
are so arranged that no mutual
action is caused, or else a com-
d network can be used which
tself will produce the complete
ay curve.
gure 4 shows the individual
constant networks and also the
bined network.
nce the impedances of the net-
ks shown follow the same fre-
ncy response as the desired re-
curve, they can be used in any
nit where the impedance of the
work controls the frequency
onse, e.g. as part of a potentio-
er, or as a feedback impedance.

33⅓ and 45 r.p.m. records. Overall replay characteristic dB	Frequency c/s	78 r.p.m. records. Overall replay characteristic dB
18·7	30	15·7
17·0	50	14·1
13·2	100	10·3
8·3	200	5·9
5·6	300	3·6
2·7	500	1·6
0·1	1000	0·1
— 2·5	2000	— 1·3
— 4·6	3000	— 2·7
— 8·1	5000	— 5·4
—13·6	10000	—10·4
—17·1	15000	—13·7

Figure 3 table of frequencies against required response figures.

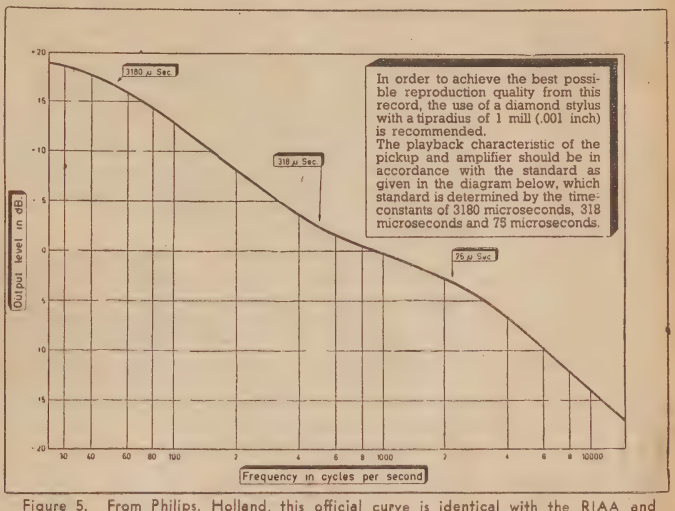

Figure 5. From Philips, Holland, this official curve is identical with the RIAA and those in figure 1 for HMV, Columbia and Parlophone.

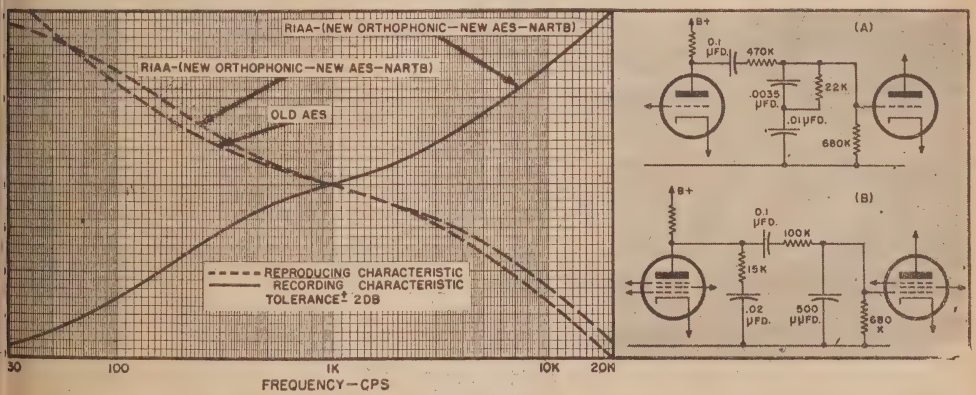

Figure 6: The original RIAA curve, reprinted from our October 1954 issue.

f course, due allowance must
nade for the impedances from
into which the network is oper-
g.
ie replay characteristics announ-
here are in complete accordance
those for fine groove and coarse
ve recordings as published by
British Standards Institution in
British Standard 1928-1955 for
nophone Records and Reproduc-
Equipment.

NOTES:

1. Since very few new 78 rpm classical records are issued now, the replay characteristic described above applies almost exclusively to modern popular recordings. Older classical music discs may benefit by removing or reducing the capacitor C2 in the combined network above, thereby maintaining the response flat in the top.
2. Modern 78 rpm popular music records, with their increased high frequency content, will tend to produce excessive forces between the disc walls and the soundbox stylus when used on acoustic machines. It is therefore strongly recommended in order to maintain a balanced response and to reduce distortion and record wear, that "soft tone", i.e., a thinner and more flexible needle, be used in acoustic machine soundboxes.

Another Milestone in the Search for

QUALITY with ECONOMY

By accepting reasonable limitations in the input and output stages MULLARD ha produced a design for a high-quality, reasonably-priced Amplifier. This Amplifier h now been produced, for your enjoyment, by GRAMPIAN REPRODUCERS LTD. (En land), Manufacturers of the World's Finest Recording Equipment.

GRAMPIAN

QUALITY

ECONOMY

MULLARD

This amplifier, based on the well-known "Mullard 5-10", incorporates some improvements on the original layout. It is intended for use with crystal pickups and fully complies with the circuit specification. The separate control unit which can be fitted in the top or front of the cabinet has a mains on/off switch, pilot lamp, volume control, bass and treble tone controls and three-position switch giving the necessary compensation for L.P., 78 r.p.m. records or radio input. The circuit is a thr stage one with 26db of negative feedback taken from output to input stage. The high gain input stage, EF is directly coupled to the phase splitter, ECC83, wh feeds the output stage employing two pentodes in pu pull, 2-EL84. H.T. supply is by a GZ30 rectifier va

TECHNICAL DATA

Power Ouput, rated	10 watts
Power Output, maximum	12-13 watts
Total Harmonic Distortion	Less than 0.4 pc at 40c/s
	Less than 0.2 pc at 400c/s
	Less than 0.3 pc at 2.000 c/s
Hum and Noise	—73db relative to 10 watts
Frequency Response	plus or minus 0.5db 10c/s to 20,000 c/s
Input impedance, pickup	1 megohm
Sensitivity, pickup	600 m.v. to give max. output
Sensitivity, radio	350 m.v. to give max. output
Treble tone control continuously variable	—10 to +10 db at 10,000
Bass tone control continuously variable	—5 db to +11 db at 20
Output impedance	15 or 4 o
Mains supply	200-240 volts A.C. 50
Mains consumption	72 w
Supply available to radio unit	H.T. 250 volts 40 m. a Heaters 6.3 volts 3 a
Finish	Old Gold Ham

RETAIL PRICE 49 Gns.

Supplied complete with 10 feet three core mains lead, screened leads for pickup and control unit to amplifier, co-axial socket for radio input and one pickup equaliser, type U giving substantially correct equali tion for most types of crystal pickups. Spe equalisers for Collaro, Acos and Garrard heads will available.

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VOLTAGE STABILISER IS SEALED ACCUMULATOR

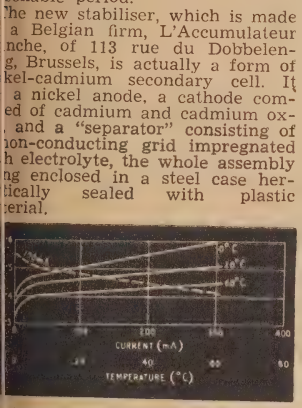
Voltage stabilisation circuits usually involve gas discharge tubes operating at moderately high voltages, or relatively complex multi-valve devices; also more suited to high than low voltages. It is therefore interesting to hear of a new kind of stabiliser, working on an entirely different principle, which gives a stabilised voltage as low as 1.5 volts.

THE idea particularly intrigued us because we had fostered a nilar, if less refined, scheme for e purpose of supplying 1.5 volt lves with filament voltage from mains-operated supply (October, 48).

Not only must such a supply be remely well filtered if hum is to avoided but it must also be sufently stable to avoid damaging valve filaments by reason of sud- surges of any kind.

We used a simple torch cell for purpose, reasoning that even if life was not indefinite, it was ap enough to replace after a sonable period.

The new stabiliser, which is made a Belgian firm, L'Accumulateur nche, of 113 rue du Dobbelen- g, Brussels, is actually a form of kel-cadmium secondary cell. It a nickel anode, a cathode com- ed of cadmium and cadmium ox- and a "separator" consisting of ion-conducting grid impregnated h electrolyte, the whole assembly ng enclosed in a steel case her- tically sealed with plastic erial.



abilisation characteristics of the cell th varying current and temperature.

hen current passes through the the cadmium oxide in the cath- is reduced to cadmium, while ne anode oxygen is evolved. This gen passes through the separator he cathode, where it once again ises the cadmium which has al- y been produced by the electro- current.

s this process is absolutely cyclic xcess gas is formed and the in- al pressure remains constant, this is what makes it possible seal the cell hermetically and e it into a practical radio com- nt.

potential is set up at the cathode he reduction of the oxide and her at the anode by the effect of evolution of oxygen on the nickel. e two potentials are very little ted by the current flowing, so the voltage across the terminals e cell is practically independent e current which passes through

e actual characteristics of the tiser can be seen from Fig. 1, h shows the voltage at the ter- ls with varying current for three ant temperatures (full-line es) and also the voltage with ng temperature and constant rrent (broken-line curve).

o. Television & Hobbies, June, 1956

Two versions of the cell are available, each having a range of types with current ratings from 20 mA to 1 amp. The first version is notable for its low impedance, which is 1 ohm or less, depending on the type. This impedance is practically independent of the frequency, and is also independent of the current as long as the maximum amplitude of the alternating current is smaller than the direct current passing through the cell.

The second version of cell is characterised by the ability to store a certain amount of electrical energy for a short time to tide over possible breakdowns in the mains supply. This is done by including nickel oxide in the anode, and as a result the cell will maintain a voltage of 1.2 volts at maximum current output for a period of one minute.

It goes without saying that several of these stabiliser cells can be connected in series or parallel to make up required voltages or currents. The life of the cells is claimed to be about 10,000 hours.

Apart from the obvious applications in stabilising valve filament supplies (and heater supplies, if they are DC), the device looks quite promising for use in the cathode circuits of valves in place of the usual bias resistor and capacitor.

The advantage here is that it will give a bias voltage that is almost independent of the cathode current, and this may be particularly useful in Class-B amplifiers and other valve circuits where it is sometimes necessary to provide a separate bias supply. ("Wireless World").

NOVEL TV AERIAL FROM U.K.

Television aerials are very much in the news lately and, as far as the designer is concerned, present a number of very sticky problems. The final result is invariably a compromise between the requirements of high gain on the one hand, and wide frequency coverage and reasonable simplicity (with moderate cost) on the other.

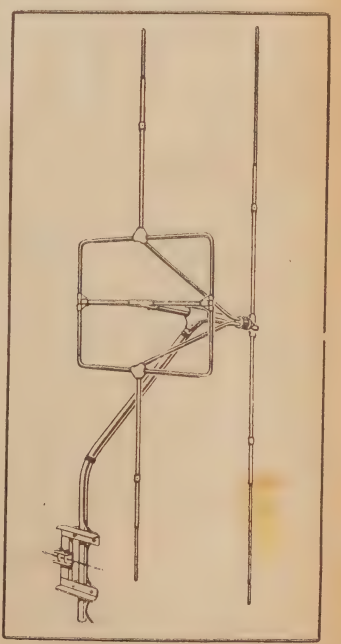
OF particular interest, therefore, is a design recently developed in Britain and known as the skeleton horn. The makers state that the principle is similar to that of the skeleton slot antenna in that the performance is almost identical with that of a normal horn, but the mode of operation is entirely different.

The skeleton horn consists of two types of antenna combined, namely a development of the skeleton slot, plus a "V" type antenna added to give unidirectional operation.

The two great advantages of the skeleton horn are, firstly, that the gain is substantially constant throughout the band 170-230 Mcs and, secondly, that lower frequency band elements (around 50-70 Mcs) can be added to the horn section without adverse effect on performance. Both sections may be fed into a common feeder.

The gain (over a simple dipole) of this arrangement appears to be quite good, being 6 db at the lower frequencies and ranging from 7 db to 9 db between 170 and 230 Mcs.

The illustration shows a typical example of this design and the makers also point out that it is equally suitable for horizontal operation and, in fact, it can be converted quite simply by rotating the whole assembly about its major support point.



The skeleton horn type aerial for television reception. Note the "V" section behind the rectangular aperture which provides the directional characteristic.

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You can now replace worn out tips without removing the baton from the cartridge. Clip-in tip makes stylus changes effortless. Available in both Sapphire and Diamond Tips.

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TYPE	TIP COLOUR	DESCRIPTION	PRICE
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AEJ-03S	None	78 Sapphire	£2 6 4
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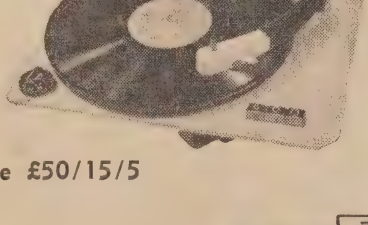
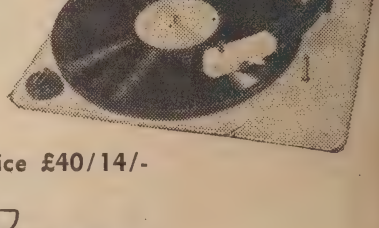


Price £50/15/5

THE NEW CB33N



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FROM THE EDITOR—OVERSEAS

ighlight of my stay in Holland from a technical point of view was a sit to Philips, a tremendously influential undertaking in the world of radio and electronics.

E town of Eindhoven houses the main factories in which 0 people find employment. You see the huge buildings for miles ed by the bright glare from the phouse where high-powered s are on test — a beacon night day announcing the research production which hums beneath

t the firm no longer encourages dea of Eindhoven as "its" town. men who conducted my tour of factories were quick to insist there were many other indus- They are keenly aware of the er of mass production extending e individual worker.

is symbolical, too, because the was born through the efforts of Frederick Philips and his son Gerard to make a success of the revolutionary electric lamp, vastly different in 1891 from the coiled-coil product of today.

To save the firm from bankruptcy, Anton Philips, a younger son, and bank-trained, joined up in 1893. When he succeeded his father in 1922, the modern Philips organisation was firmly founded.

Anton was a salesman and a genius The separation of sales from development and manufacture upon which he insisted has remained even today a feature of Philips, now operated by a board of management. It is a policy largely responsible for the tough business core of the company, blending imagination and enterprise with hard-headed efficiency.

Lamp-making led to valve-making. As quantities mounted, the firm worked back to the security of its raw material by large glass and wire-making plants, and forward to the inevitable electronic development in which its products are used.

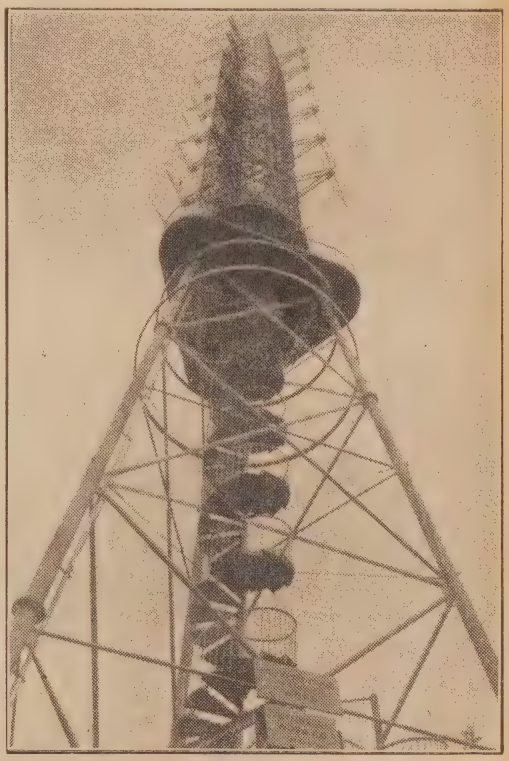
Thus you find Philips making cardboard containers, ceramics, x-ray and medical apparatus, radio and TV receivers, fabricating and plating metal, drying paint by infra-red, making loudspeakers, artificial resins, investigating plant diseases and preparing vitamins and isotopes.

It deals with competition largely by selling its products to them. It succeeds overseas by identifying its activities with the countries in which it operates. Outside Holland its world-wide organisation employs nearly 70,000 people.

In Holland they are intensely proud of Philips. A woman in my

(Continued on Page 29)

low) Perched 3900 metres above sea level, this transmitter-eiver installation is one of the links which carry "Eurovision" other VHF-borne traffic across the Alps. The snow, the ip slopes and the generally bleak outlook are typical for type of installation. Operating frequencies are in the ge 1700-2300Mc. The photograph was taken by Dr. Wehlin ef Engineer of Hassler, who have supplied a good deal his gear, much of it manufactured under licence from the General Electric Co., England.



(Above) A TV aerial system at Banteiger, just outside Berne, Switzerland. This particular one operates on band I (47-53Mc), has a bandwidth of about 5.5Mc and a gain of about 4 times. The mast also carries parabolas for a microwave link, which actually forms part of the Eurovision network. It can intercept programmes from the link, use them locally as required and, at the same time, send them on their way over the mountains. The station is housed in a hut beneath the mast and is generally unattended, as are most of the links. Local inhabitants are allowed to climb the tower for the view.

IRC AUSTRALIA

FIT New type LB1 Continuously Compensated Variable LOUDNESS CONTROL TO YOUR RADIO OR AMPLIFIER

...and automatically keep the proper balance of all frequencies within the audio range at ANY listening level!

(Patent Applied for No. N11262)

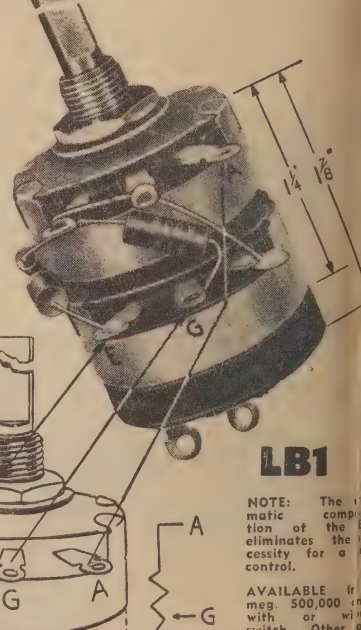
For many years there has been a need for a volume control in audio systems which would automatically keep the proper balance of all frequencies within the audio range at **any** listening level. I.R.C. has developed such a control, known as the LB1, to meet this need.

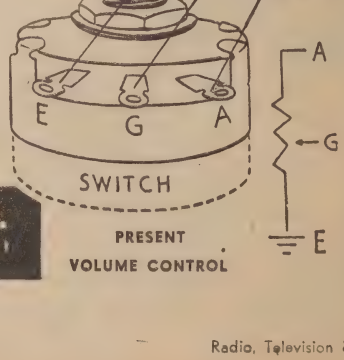
With the loudness control it is possible to reduce the output volume of any good or average audio system to a whisper and still be able to hear every tone with perfect balance, as the LB1 **provides gradually increasing high and low frequency boost** as the volume is reduced to offset the deficiencies of the human ear, **which is insensitive to high and low frequencies at low volume.** This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours.

Many attempts have been made to obtain correct tonal balance by means of tapped volume controls, various types of bass and treble boost circuits and stepped type loudness controls, but none has given the performance of a truly continuously variable loudness control such as the new I.R.C. LB1.

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.

Contact your usual supplier for illustrated literature.





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FROM THE EDITOR—

ain compartment who had sat lently during the journey from msterdam became immediately ocal when she saw my obvious in- rest in the procession of buildings s we reached our destination. Philips!" she announced. In any nguage she knew I would under- and what she meant.

Although to a certain extent this inevitable, it is a type of thinking pon which they wage a material id psychological war.

On the production lines, the work- s have their individual places and ols, they are names and not num- rs. Production schedules are care- lly watched, but there are no and-over methods. Extra produc- on is rewarded, social schemes ound, medical care, treatment, and dustrial research occupy a whole ock.

It takes a motorcar to drive around ndhoven factories unless you have enty of time to walk. In the morn- g the place is invaded by an army bicycles.

r. ANTON PHILIPS

In the square near the beginnings the new railway station, built to pair war damage which also wiped t one-third of the factories, is statue of Dr. Anton Philips, solid its self-statement, erected by the izens of the town to honor the man no was so largely its architect.

But perhaps the firm is most proud the original factory, still standing, nere its products were born more an 60 years ago.

Among the obvious things I saw at ilips were radio and TV assembly es, fed by automatic transports, d turning out completed receivers two or three hours. The "sticky" ts are sub-assemblies, pre-tested fore being mounted and wired. binets and packing are arranged keep a smooth flow to waiting ilway transport inside the yards. Not so obvious are the glass- aking machines, carefully balanced nbinations of material control and ning. The raw materials are ovelled into the furnaces at the ; at the bottom emerge dollops hot glass, exactly the right size, that when they pass around the ating carriages which form them, actly the right shape and weight bulb results.

BOUNCES!

When annealed you can drop one uarely on the concrete floor and will bounce back unbroken!

In a large, superbly appointed dio for speaker testing, movie and ge screen projection, &c., I was en a demonstration of high- elity stereophonic sound.

Through lowered lights and two nd channels, a recording of street ises included the sound of chil- en at play, motor-scooters (with ich Europe is infested) apparently zzing across the far end of the atre, and some unforeseen vocal nments from the Dutch equivalent Bill and Joe which must have en very funny judging by the ghs from those who understood un!

Then I heard some recordings of ans and choirs, showing the use added reverberation and dynamic ntrol to perfectly straightforward originals. They were not products of the recording factory—they merely demonstrated results of the research department which here was playing with sound.

The factory where Philips' records are cut, processed and stamped is some miles away in the town of Baarn, quite close to the school where the Dutch Royal Princesses go to school. This part of Holland is wooded and lovely, a strong contrast to the miles of flat country — riddled with canals and spattered with windmills—which dominates the South.

"OFFICIAL" TRADITION

Incidentally these windmills are the traditional trade-mark of the Netherlands — every owner must keep his mill in good condition, at least outwardly, whether he uses it or not. There are still several thousand mills in Holland.

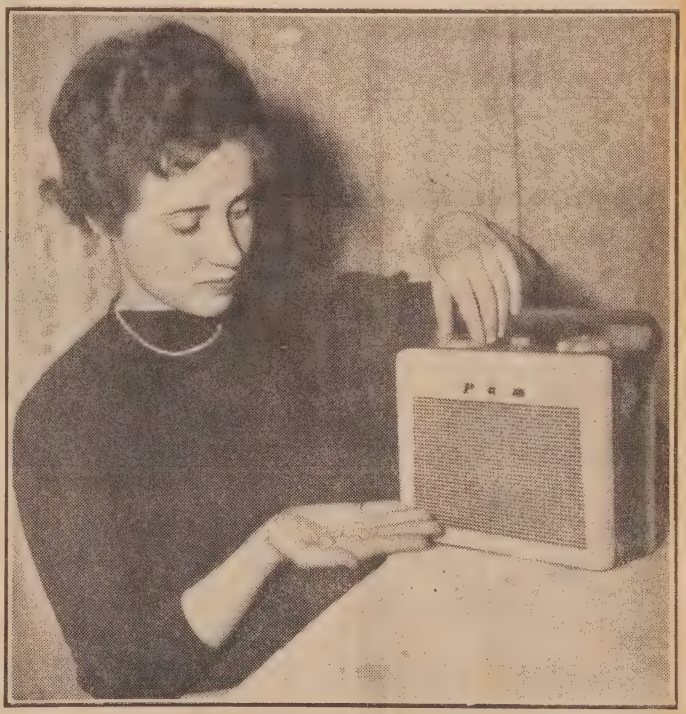
Hilversum is the home of the factories where the big transmitters for communications and TV are designed and built. Here I looked over equipment similar to that already in Australia for TV service, and through the windows of the upper storeys I could see the Zuider Zee, that vast inland lake which the Dutch are slowly reclaiming to add millions more acres of fertile land to their country.

Finally a word of thanks to the many people at Philips who were so friendly and hospitable. I am sure that if I were to return tomorrow, "Welcome" would still be there. It was the first word I heard, even before I arrived.

I came to Amsterdam, probably the best-known city in Holland, late one night after a train journey from Cologne. It was cold, and I was completely sympathetic with a Greek fellow traveller who was hauled off the train at Arnhem at 10.30 pm because his visa wasn't in order. His English was very poor, but the Dutch official's Greek was much worse! I often wonder where he slept that night. I fear it wasn't in Amsterdam!

I found the citizens particularly friendly and helpful; their city colorful and charming. Old Amsterdam exists very much as it has done for hundreds of years. Ancient mariners still wear peaked caps and grizzled beards, and occasionally the rattle of clogs on the cobblestones rings down the narrow streets.

Here, too, are shops exuding the salt tang of rope and herrings, and on a sunny, busy Saturday morning the ways are abustle with people and children, bright with play. Outside the city area traditional Dutch

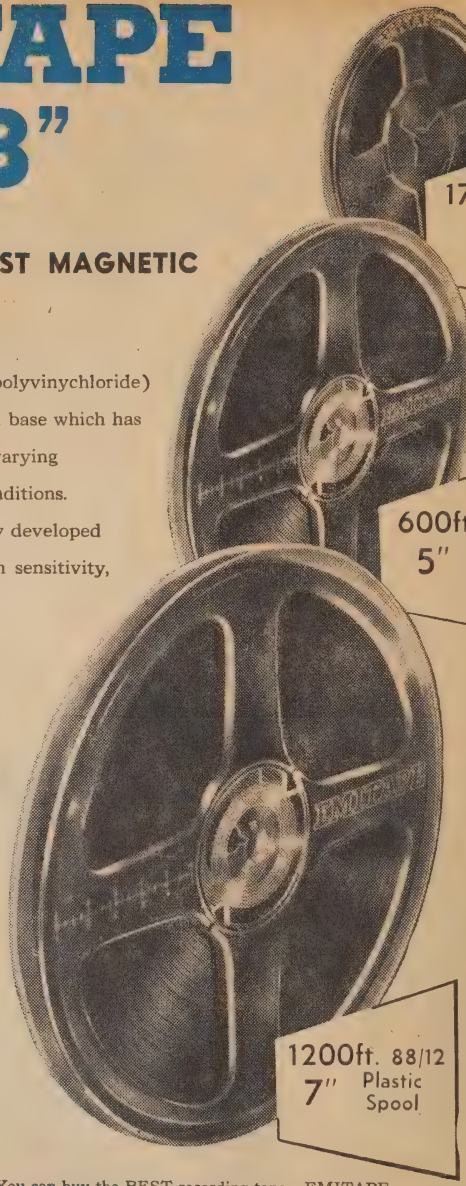


The first British-made commercial radio using transistors in place of valves was shown in London recently. In this picture, a model is shown holding some of the transistors in the palm of her hand. Size of the set is largely dictated by the size and efficiency of the speaker which is used. However, the operating costs are about one tenth those of a normal portable receiver. The whole set runs on four small torch batteries.

EMITAPE "88"

THE WORLD'S FINEST MAGNETIC RECORDING TAPE

EMITAPE "88" uses P.V.C. (polyvinychloride) high tensile film base—the film base which has strength *plus* stability under varying temperature and humidity conditions. EMITAPE "88" has a specially developed magnetic oxide coating of high sensitivity, with an electrical specification designed to achieve the maximum performance from all tape recorders, all speeds, single or twin track.



EMITAPE is used by the leading Broadcasting organisations and for the recordings issued under these world-famous trade-marks —

"HIS MASTER'S VOICE"

COLUMBIA

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You can buy the BEST recording tape—EMITAPE—at these *new reduced prices!*

88/3—price, 12/-. The finest value for short duration recordings, giving over 8½ minutes' single or over 17 minutes' twin track at the speed of 3¾" per second. The ideal "Personal Message" medium for the mail.

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TR.11.FD

ROM THE EDITOR—

lls set their sails above the farm-
d flats and gay tulip fields.
Amsterdam still guards the old
als which circle it in expanding
gs. Long since abandoned for
ious traffic, they are a gold-mine
elaborate pleasure boats, backing
filling through the narrow
ners, expertly guided under age-
bridges with only a few inches
spare.

here are more miles of canals
Amsterdam than there are in
lice—completely unprotected from
roadways which run alongside,
a graveyard for careless motor
s. The city crawls with 500,000
cles, ridden by everybody in-
ling sober-habited businessmen
grey-haired matrons.

lere you will find the narrowest
et in the world—3ft wide—and
narrowest house — exactly the
lth of a doorway. You may take
r morning coffee in a street-side
, and listen to an honest-to-
dness barrel organ which solidi-
with amazing mobility around
ry second street corner.

f you are so inclined, you may
hear one of the world's best
hestras at the Concertgebouw, an
itorium almost unrivalled in
ustic perfection.

'elevision in Holland uses the
R 625 lines system, and is oper-
ed by the Netherlands Foundation
T) from equipment supplied
ough the PTT (PMG). The pro-
ms themselves are produced by
separate groups, KRO (Catho-
, NCRV (Protestant), VPRO
tholic), AVRO (General), and
RA (Labor), on a pro-rata basis.
hese companies draw some of
r revenue from program sub-
ptions, but there is also a Gov-
ment subsidy through part of the
nce fee of 30 guilders (about £3)
year. The two main stations
at Eindhoven and Lopik, each
5 KW Video ERP.

hree relay stations, two of 50
, are due this year, and another
1957. The big relay station at
rmond will shortly replace the
ion at Eindhoven.

TION AT EINDHOVEN

o far there are only 50,000 re-
ers and programs for 8-10 hours
week, so that TV in Holland
not be said to have progressed
r far. This is due probably to
nomics, and maybe to a cer-
conservatism in the Dutch
ple, who are not inclined to rush
new ventures. All links are
micro-wave stations.

om figures supplied to me—it is
n difficult to achieve accuracy
these estimates—the 17in tube
ns to be easily the most popular,
t 70 pc of the total. There are
ir number of 21in tubes, and a
model is projected for the near
re. As might be expected, a
proportion of Dutch radio
pment comes from Philips.

ne general background of radio
inistration is the same as that
TV. There are several medium-
e stations, and a complete FM.
work is in the process of being
latter a necessity, some suspect
alled. Some engineers consider
s merely the fashion.

My own reaction is that the Netherlands has medium-wave interference as much as any other country in Europe, and there is little doubt that the FM scheme will go ahead.

There is no commercial TV or broadcasting in the Netherlands, and there appears to be a strong feeling against it in many quarters. But in the opinion of many engineers and radio people, even those of the anti-group, it is the only way to supplement funds for expansion of TV and even of radio. I formed the impression that Holland will hear more of it quite soon.

BELGIAN SCENE

Belgium suffers the pros and cons of a vulnerable buffer State between neighbors whose differences of opinion have made history through the centuries.

Journeying overland from Amsterdam to Brussels, through The Hague, Delft, the home of Vermeer, Rotterdam, victim of the last war's most vicious bombing, and later through the green fields near Mons and Amiens, it is easy to see how the swarms of Hitler tanks erupted over the country with scarcely a stick to bar their progress.

On the other hand, the strategic position of Brussels has made it an important focal point for traffic and trade. Its streets hum with activity and life for 24 hours a day. Its cafes and theatres are always open, it has modern speed and apparent plenty, mixed with medieval atmosphere, old buildings, gilt paint, a tiny but celebrated statue, the subject of much outrageous humor.

CONFUSION

Nearby are the famous fields of Waterloo—in actual fact the battle was fought several miles away—crowned by a statue of a Dutch lion on a hill created by peasant women who carried every grain of earth in baskets on their backs.

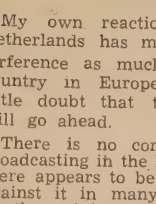
Belgium's national mixtures are Flemish and French, and the need to cater for both has complicated the radio system. So has the nearby existence of 625-line TV stations in Holland and Germany, and the 819 transmitters of France, plus variations peculiar to Belgium.

There are four stations, two in French and two in Flemish. The French-speaking stations use 819 lines, with a bandwidth of only 7 Mc as against the French 11 Mc, and the 625-line Flemish speaking stations depart from the CCIR standard by using positive picture modulation and AM sound.

As an example of the mess caused by non-standardisation, things could scarcely be worse. It means that a really useful receiver in Belgium brings joy to slide-rule, but panic to pocket.

Programs are non-commercial, and average about 18 hours per week. The operating authority is the National Radiodiffusion Institute. Finance comes from a Government subsidy, and portion of licence fees.

"WILLIS" Chassis Punches



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3/4"	24/6	1 1/2"	47/6
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7/8in	29/4	2 1/4in	81/7
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1-1/8in	34/10		
1 1/4in	34/10		
1-3/8in	38/6	Keys, all sizes	1/8
1 1/2in	38/6		

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The "Q-Max" Model GDO-1A is a high frequency grid dip oscillator with a built-in mains power pack.

FREQUENCY RANGES

"A" 1.5-2.9 Mc. "B" 2.9-5.6 Mc.
"C" 5.6-10.5 Mc. "D" 10.5-20 Mc.
"E" 20-39 Mc. "F" 39-75 Mc.
"G" 75-175 Mc. "H" 150-300 Mc.

APPLICATIONS

(a) Determination of the resonant frequency of tuned circuits.
(b) Tuning transmitter circuits without the application of power.
(c) Determination of coil, mutual and stray inductances.
(d) Determination of the capacitance of condensers, both fixed and variable, together with circuit and stray capacitance.

PRICE (Amateur Nett):
£25/-/-
plus 12½% Sales Tax

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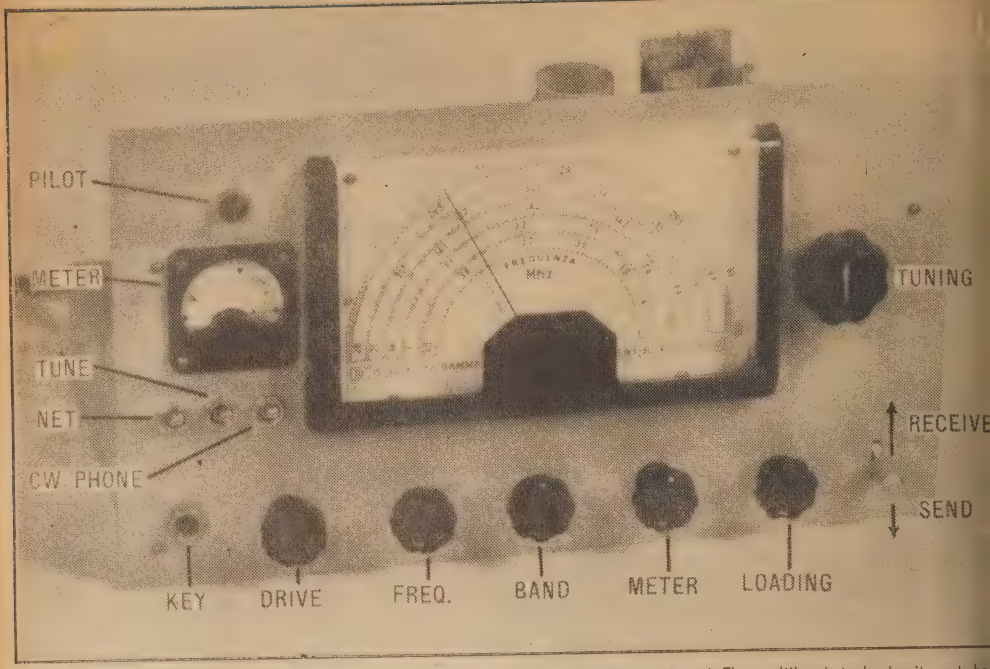


Our new transmitter is right up to 1956 standard in the matter of operating convenience! The multiband tank circuit and ba switched VFO eliminate plug-in coils sa that all adjustments and bandchanging are done by means of panel controls. Panel siz 15in by 8½in.

COMPLETING YOUR TRANSMITTE

The transmitter described in the April 1956 issue showed a simple and effective way using the Geloso VFO unit. It is eminently suitable to replace existing transmitters ar use existing power supplies, modulators and control systems. On the other hand if you a starting from the beginning, all the facilities that go towards making a smooth and effic ent station can best be built into the transmitter chassis. It is the purpose of this article show one way that this can be done.

INSTANTANEOUS changeover from send to receive is a "must" for a modern amateur station and, among the other desirable features is a means of adjusting the carrier frequency to coincide with other stations working on the same band; not forgetting, of course, the problems of keying the transmitter for CW working.

These problems should not be dismissed as simply a matter of throwing a switch or placing a key in the cathode of the final amplifier, as the case may be, if good results are required.

First of all the matter of changing over from send to receive. Most amateurs will, with a thought to nearby television receivers, wish to instal the transmitter in a metal desk cabinet. The logical place then for the send/receive switch is on the front panel of the transmitter itself.

Further, bearing in mind that it will come in for a good deal of hard work during a snappy operating period, a telephone type key switch, rather than a toggle switch, is a good choice for the job. Various types of key switches are available through the disposals dealers.

by Maurice Findlay

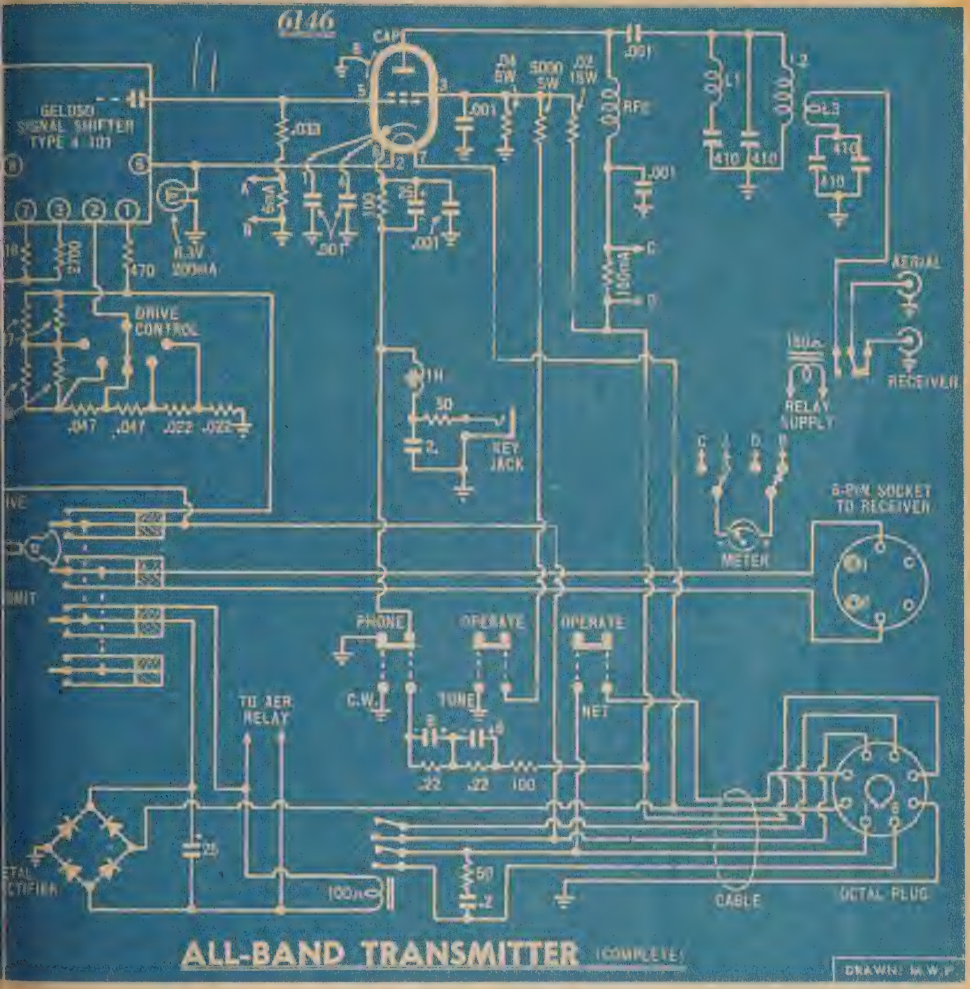
Although the lever mechanis designed for heavy duty service forunately the contacts on the switch are not rugged enoug switch the power supplies dir and it is necessary to use a q acting heavy-duty relay.

In this case the filaments o valves must be kept warm d the standby period so that the no alternative but to switch DC cuits.

Whenever separate transfo for filament and high tension plies are available we always to switch the AC primaries o high tension transformers r than the DC return circuits.

On the credit side, there are p of heavy duty, quick acting r available from the disposals d

CIRCUIT HAS ALL NECESSARY CONTROL FEATURES



The switching circuits needed for a smooth and rapid change from send to receive are included in the transmitter circuit. The relays, rectifier and some of the heavy duty resistors will be available cheaply from disposals stores.

are capable of handling the main requirements of the re- re that it have two pairs of substantial contacts capable sing two separate circuits in n" position, that the contacts ll apart on the "off" position event arcing, and that the eover be rapid.

meet these requirements and le reliably from about 12 volts, elay coil will most probably a DC resistance of 100 ohms s. There are so many different that the final choice is a mat- r the individual.

r, if any, of these relays are le for AC excitation, which s it necessary to instal a recti- Here again, there is more than one type available from the disposals dealers and a choice must be made knowing the current required. In our case a pair of telephone type copper oxide rectifiers connected in parallel did a fine job but, if you use relays with lower resistance, it may be necessary to connect three or more rectifiers in parallel.

The receiver high tension requirements are usually not so great that they cannot be handled by the key switch contacts directly. It is in order therefore to bring a pair of leads out directly from the key switch to a socket on the rear of the chassis to control the receiver high tension, either at the centre tap or some other suitable position.

Very large receivers could be controlled by a set of reverse contacts on the main relay but this is not as easy as may first appear.

The capacitors in the transmitter power supply keep the transmitter operative for a short time after the relay circuit opens. Similarly on the

COIL DATA

L1: 10T 14 SWG wound 6TPI on 1¼in diameter former. (Approx. 1⅝in long).
L2: 14T 18 SWG wound 10TPI on 1¼in diameter former. (Approx. 1⅝in long).
L3 3T 18 SWG closewound self supporting 1¼in diameter. Fitted around earthy end of L2.
Note: 12 B & S is approximately equal to 14 SWG and 16 B & S to 18 SWG.

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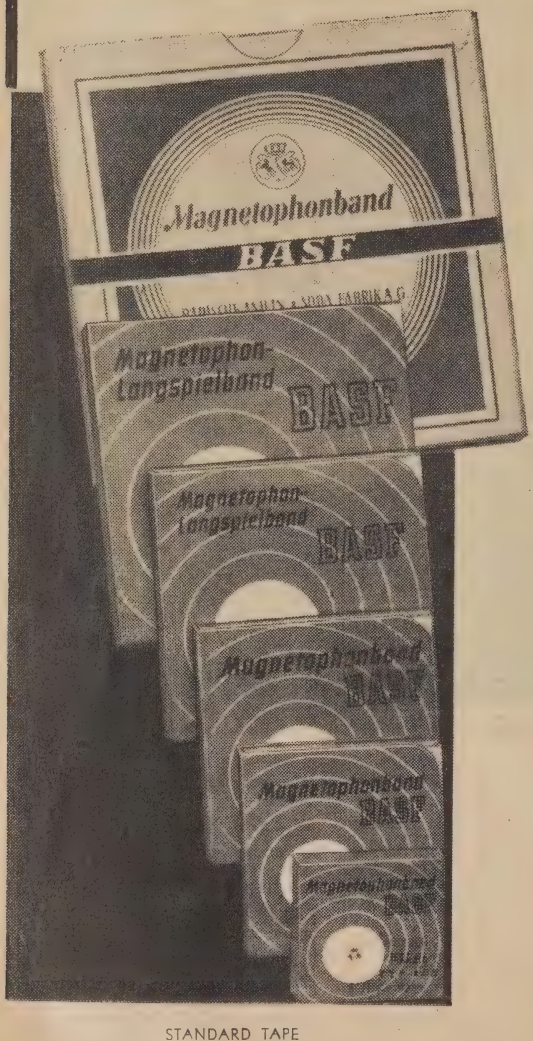

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BASF

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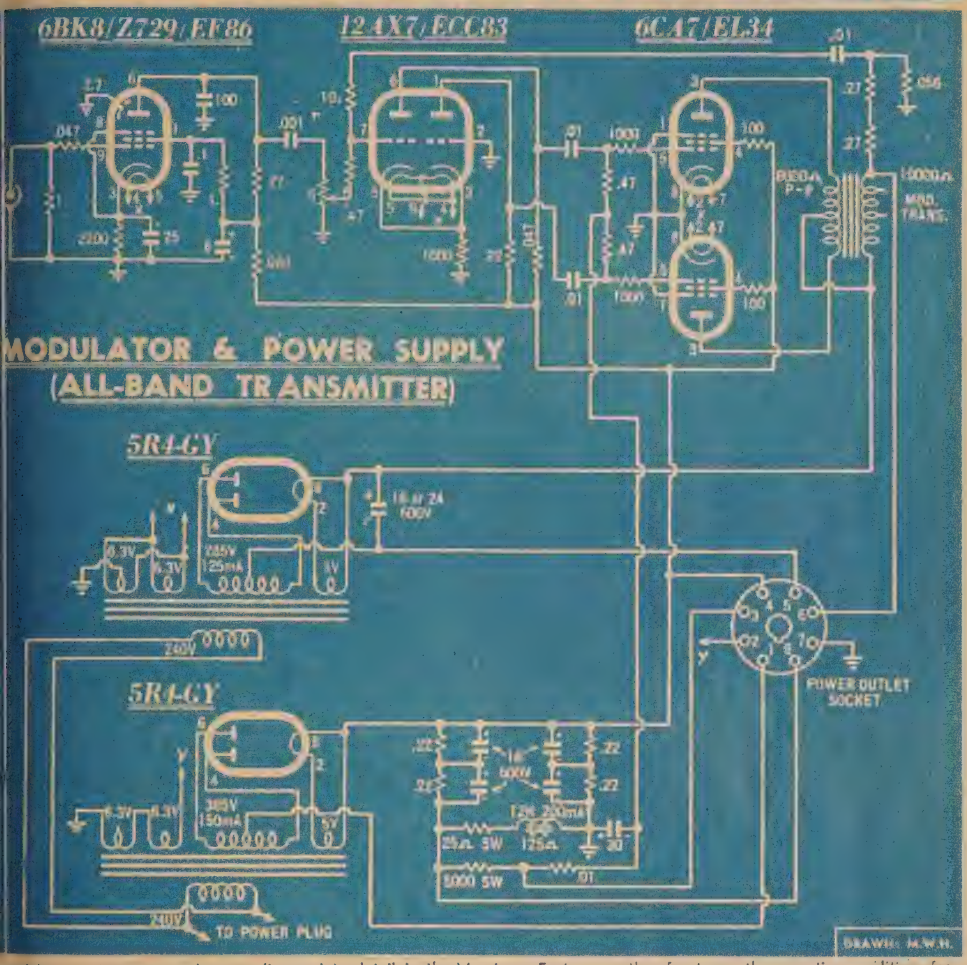
AUDIO & POWER UNIT COMPLETES TRANSMITTER



enodulator and power supply were discussed in detail in the May issue. Features worthy of note are the operating conditions for the 6CA7 modulator valves and the power supply which uses receiver type transformers.

re from receive to send the fil- pacitors in the receiver power r keep the receiver alive long h in most cases to cause ic feedback between the loud- er and the microphone.

effect is particularly unpleas- the transmitter and receiver n to be tuned to the same fre- y, as is very often the case.

imple and satisfactory way of ming the trouble is to place t on part of the high tension transmitter or receiver when her is operating. The micro- preamplifier of the modulator e oscillator section of the re- are often suitable points.

irect short would damage the ts of the switch or relay apart other components and it is re- nded that a limiting resistor luded. A suitable value is about 100 ohms.

This technique will be of interest if you wish to mount the control switch away from the transmitter and control the latter through a pair of wires.

In our case a good deal of trouble is saved by making use of the three positions of the key switch. The top position is "receive" the middle position "off" and the bottom position "transmit" and there is inevitably a short period during the operation of the switch when neither the transmitter nor the receiver is connected.

Another advantage of the arrangement is that both the transmitter and receiver can be switched off if necessary. You may, for example, have a separate VHF station in the same room, when this facility would be very valuable.

Note that the high tension for the 6V6-GT driver valve goes through the key switch and is only connected in the "transmit" position. The purpose of this is to prevent the 6V6-GT from operating when the oscillator is switched in for netting. It is worthwhile bending the contacts of the key switch to make sure that the circuit is closed before the relay circuit closes.

Should the reverse be the case the final amplifier will have high tension applied but no drive for a short period.

Further to the general subject of switching, it is possible to reduce the arc caused by an inductive "kick" when a circuit is broken by placing a capacitor across the relay contacts. A small value resistor must be connected in series with the capacitor in order to limit the peak discharge current when the contacts close again.

Apart from the power supply

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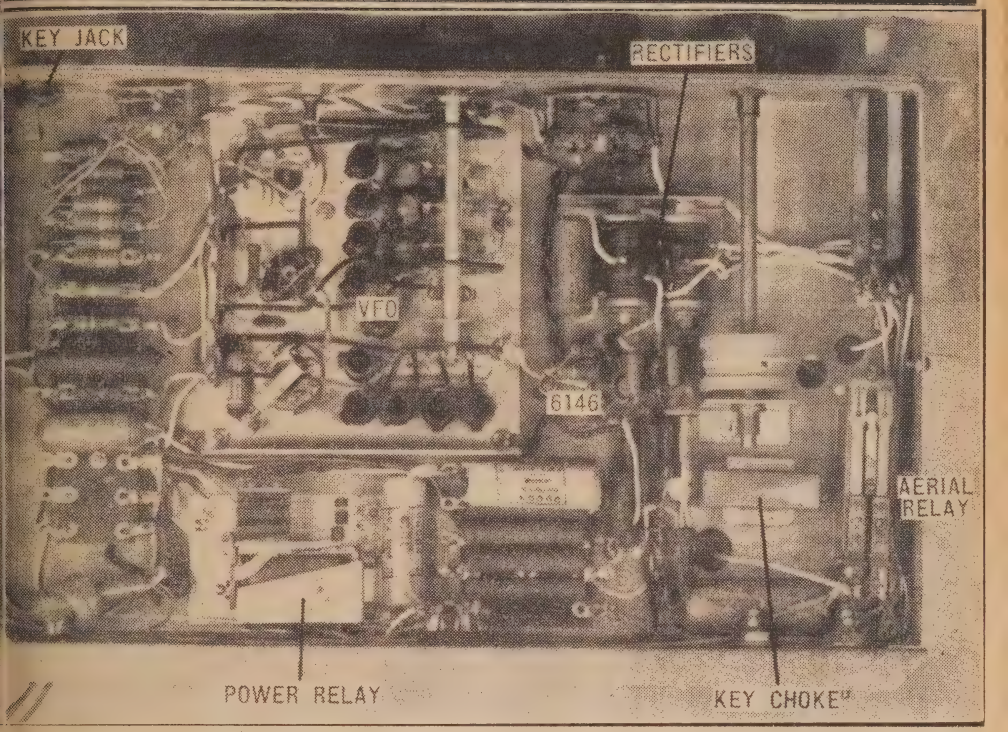
UNDERNEATH VIEW OF THE ALL-BAND RF CHASSIS



Under chassis components have been placed to allow easy access for testing and service. There is ample room for alternatives you wish to use components from your present stocks. The homemade drum forming part of the loading control mechanism appears towards the right in this view.

ining, the incoming aerial lead s be changed over from the mitter to the receiver and if n is any doubt about the high ency properties of the key h, a separate relay should be In order to cope with the ced system as described in the issue, a two-pole two-position is needed but a single pole, osition relay is sufficient when ial line is used.

s relay need not be very big here are often suitable relays special high frequency insula- available from the disposals s. If the resistance of the coil low you may have difficulty oviding a rectifier sufficiently d to handle the current.

ER RESISTANCE?

the other hand, if the resist- f the relay coil is greater than 500 ohms it may be possible just for reliable operation on ectified 12.6 volts from the nt network.

s takes care of the main con- nctions but there are a num- of others which make for rable and efficient operating.

example, half the advantage variable frequency transmitter ability to place your carrier y desired spot on the band in n to other stations heard in ceiver. When more than two stations are engaged in a round table hook-up it is very much easier if you are able to tune your carrier zero beat with the other stations. Nobody will then have to retune as the conversation is passed around.

The best way to do this is to switch on the oscillator only. The beat note between the oscillator and the incoming signal can then be heard in the receiver. In our case there is something to be said for switching on the 6AU6 isolating stage at the same time so that the operating conditions for the oscillator are exactly the same as when the high powered stages are switched on.

Normally there is no need for any special coupling between the oscillator and the receiver. In fact, the stray signal pickup usually tends to be a little too strong, particularly when the transmitter is not in its metal cabinet but an accurate netting adjustment can be made with a big ratio between oscillator and incoming signal strengths. It takes only a matter of seconds.

The voltage applied to the oscillator when the adjustment is made should be as close as possible to the normal operating voltage. As we mentioned in the April issue, the oscillator is fairly tolerant of changes in supply voltage but it is only necessary to include the one resistor to make up for the regulation of the power supply.

By experiment we found that the correct value for this resistor is 5000 ohms approx and therefore a resistor of this value is included. The actual resistor is in the modulator chassis and you can see by inspecting the circuit that it can be brought into operation by closing pins 1 and 3 of the power outlet socket rather than pins 1 and 8 as for normal operation.

HIGHER BIAS

On closer study, you will see also that a high negative bias is applied to the grids of the 6CA7's in which case the application of screen voltage to the 6CA7's without plate voltage is not damaging.

The netting function is controlled by a toggle switch mounted on the front panel.

If the plate circuit of 6146 is mistuned with full voltages applied the plate dissipation of the valve will be greatly exceeded. It is a great convenience therefore if a simple means can be found to reduce the maximum current until the correct tuning point is found when it is safe to switch to full power.

We found that a very satisfactory way of achieving the desired result is to reduce the screen voltage of the 6146 and this is done by switching a 5000 ohm resistor from the screen to earth. The plate tank circuit can then be tuned to any posi-

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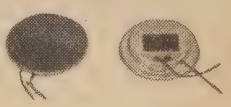

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Q-PLUS
Crystal sets. In attractive cre plastic case. Latest circuit incorp ating the fixed germanium diode tector. **52/9**

BROWN
High grade British headphones. 4 ohms, complete with heavy duty cor **55/-**

UNIVERSITY
0-1 milliamp meters. Rectangular ty with multiscale, as used in R & multimeters. **£5/6/10**

SLIPNOT
Insultation tape. This is best qual and fresh stock. 10yd x 5/8in. Barga price **1/8**

SPAGHETTI
Yellow varnished cambric. 5mm on This excellent spaghetti is at c price. **9d per yard.**

SWITCHES
Wafer type double pole, double thro with long spindle. Bargain price. **2/-**

CONNECTORS
MBC type as used in aito radio. Id as shielded pick-up connectors.
Chassis type 1
Cord connector 1

MAIL ORDERS——
PROMPT ATTENTION. ***Please all for postage in remittance.***

PRICE'S RADIO
5-6 ANGEL PLACE, SYDNEY
The Radio Specialists

without damaging the valve and
e same time the dip indicating
ance is clearly defined.
third toggle switch makes the
es necessary for phone and
peration respectively. In the
position the cathode of the
is returned to earth while for
he secondary of the modulation
former is bypassed to ground.
ugh of simple construction the
switches do not appear to
ny trouble with the voltages
ed.
matter of keying the trans-
is not as simple as may first
r and a number of compon-
ther than those in the simpler
n are necessary in order to
e a satisfactory result.

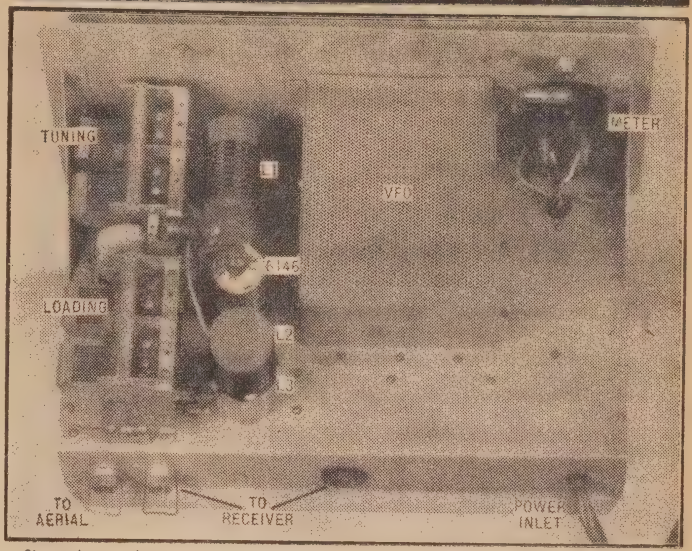
G FUNCTION

the key-down position, the
nitter must deliver its full
into the aerial and in the key-
sition the output must be cut
etely. At high keying speed
hangeover must take place in
short while, yet it should not
sudden that spurious radiation
form of clicks causes inter-
e with adjacent channels.
re are a number of ways of
ing the carrier in the desired
r and these are discussed at
in the standard textbooks.
ering all the standard methods
ing and bearing in mind the
f components the best method
s case would appear to be to
the cathode lead.
plate current can then flow
s the grid is returned to earth,
thode is forced to assume a
e voltage with respect to earth
to the grid cut-off voltage for
rticular plate and screen volt-
.
cut-off voltage rises rapidly
he screen voltage and for this
particularly with the 6146, it
desirable to use a simple series
ng resistor. We have used a
network which limits the
applied to the screen under
conditions to 400V.

R TO SPARE

dvantages of the system are
th modulator and high tension
are wasted in the resistors
e 6CA7's are able to deliver
quired power with plenty to
e
adable signal for CW can be
d simply by placing the key
cathode lead. The voltage
the key is of the order of
ts and therefore under ordin-
cumstances not likely to be
Furthermore you are not
to deliberately place your
across the key contacts.
this simple system the time
for the carrier to reach its
lue is very small. This has
ct of causing interference in
t channels due to the large
of frequency components
ed in the steep sided wave.
ar situation exists when the
e is broken suddenly.
current can be prevented
ilding up rapidly by placing
in series with the key lead.
iron cored choke is required
r experimental results indi-
t an inductance of 1 henry
ed at 10V 50 cps with no
mponent) is suitable.
tual fact the exact value is
critical. All that is required

TOP VIEW OF NEW TRANSMITTER



Since the April issue, a 2 gang capacitor has been added to allow control of the loading from the front panel. The arrangement is best suited to unbalanced output

is that the choke prevent the very steep sided wave without detracting from the crispness of the keying. With the 1H suggested there is a perceptible click when the receiver is accurately tuned with a strong carrier but there is negligible interference when the receiver is tuned a few Kc to either side. This condition makes for easy reading.

MAKING A CHOKE

The choke was made by winding 1000 turns of 35 B & S enam. wire on the core of a small speaker transformer. In our case the assembled laminations were 1¼in x 1¼in x ¼in thick. A cardboard bobbin (to fit over a ¼in x ¼in core) was made and the wire wound on with the aid of a hand drill. A layer of paper was placed between every few layers to minimise the possibility of shorts between turns.

The results will be accurate enough if you make a choke of approximately the same dimensions and with the same number of turns. There is no need to go to any trouble to check the inductance value.

The characteristic on the break can be softened by connecting a capacitor across the key terminals. When the key is opened the capacitor absorbs a charge and keeps the current flowing for a short while after the contacts have parted, gradually decreasing in amplitude. A small value of capacitor will reduce the interference on adjacent channels but it is desirable to have the break softer than the make in order to improve the readability.

We suggest a value of 2 mfd but a 1 mfd unit could be used if desired. The capacitor should be rated at about 200 volts.

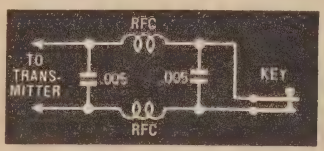
The energy stored in the capacitor is dissipated each time the key is pressed and to limit the peak current at the start of the discharge a small resistor is wired in series with the key contacts. Without the resistor, sparking will be excessive.

RF RADIATION

This brings the discussion to another important point. Sparking at the key contacts causes radio frequency energy to be radiated locally where it may cause interference in all types of receivers. This is similar to the interference caused when lights, refrigerators, &c. are turned on or off and is distinct from the interference caused by the steep fronted RF carrier.

It can be eliminated by connecting an RF filter consisting of a pair of RF chokes and a pair of small capacitors in series with the key leads but mounted right at the key itself. The circuit of a suitable filter is given here. Again, the values are not critical. In fact, in many cases a single capacitor across the key terminals will be sufficient.

The change in high tension current from key down to key up conditions is over 100 mA and therefore there is a change in the high tension voltage. Due to the storage effect of the filter capacitors, this change takes a perceptible time. It results in a slight change in the frequency of the oscillator and the after the contacts have parted, gradually decreasing in amplitude. A small value of capacitor will reduce the interference on adjacent channels but it is desirable to have the break softer than the make in order to improve the readability.



Where interference is created by sparks at the key contacts this circuit should be used. Values are not critical.

THE

Armstrong A.10 AMPLIFIER

is this much better than anything in its price class—

Check these points when buying a high fidelity amplifier—

- ☐ A six-way audio filter giving you a choice of six different curves.
- ☐ A Williamson-designed Partridge multi-match output transformer to feed any speaker impedance of 3, 4, 8, 12 or 15 ohms.
- ☐ Less than .1% distortion.
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- ☐ Separate filter for all types of recording.
- ☐ A genuine preamplifier control box.
- ☐ Ultra-linear Circuit.
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FLASHERS

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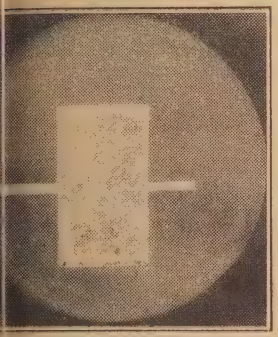
W.A.: Sales Pty. Ltd., 1142 Hay St., Perth. BA97

WHOLESALE INQUIRIES INVITED.

ll result is a slight "chirp" in
ıote when the signal is heard
st a receiver's beat frequency
ator.

the 3.5 and 7 Mc bands the
is so slight as not to worry
operators. On 14 Mc band it is
noticable and the more critical
tors would aim for something
. For 21 Mc and 28 Mc where
frequency multiplication is
r the chirp is definitely more
desirable.

therefore, you intend operat-
ı CW on the higher frequency
, a voltage regulator tube is
ble. This may conveniently be
f the standard 150 volt or 105
ıbes, or even a neon lamp with
ase resistor removed could be
The regulator should be con-
from the junction of the .018



g waveshape without the click fil-
; photographed from the screen of
O. The width of the pattern rep-
ts approx. 1/60th sec. A wave of
hape contains a large number of
and components which cause in-
rference in adjacent channels.

and 2700 ohm resistors to
il and value of the series
ng resistor (7500 ohms on the
) adjusted so that the current
h the regulator tube is within
ximum ratings when the key
Say, 20 mA would be suit-
r many of the standard tubes.
re is a substantial variation in
ate current of the modulator
during modulation which
some variation in the high
u voltage. The change in
or frequency only becomes
iable when the transmitter is
overmodulated. (Bear in
hat the 6CA7's are well cap-
f doing just this!) For the
transmitter, therefore, the
nt for a voltage regulator
s stronger than the simpler
described in the April issue
only the voltage changes due
variations were being con-

the question of frequency
y, it is very desirable that
lve shields supplied with the
unit be fitted. Without them
te of the low transmitter, on
o low frequency bands par-
y, may be poor due to exces-
ay coupling. The perforated
over the unit is helpful in
ard serving to keep the strong
rom output coils away from
circuits.

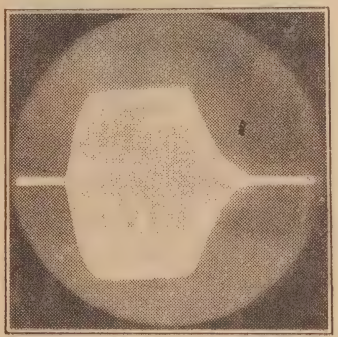
ield over the coils of the
nder the chassis could be

added with advantage if so desired. It would serve the additional purpose of eliminating hand capacity effects when adjusting the transmitter on the bench.

One 6J5-GT we tried apparently had a leak between heater and cathode inside the valve causing a rough note. A new valve completely cured the trouble.

A few remarks on the final tank circuit, loading adjustments, aerial tuning systems and aerials could well be helpful.

The fixed link system suggested previously is simple and workable where you are able to erect a series of dipoles, one for each band. (The 7 Mc dipole may be used for 21 Mc with some change in the radiation pattern.) The number of turns on the link can be adjusted to give



The time to reach full amplitude is increased by the choke and the decay time by the capacitor of the click filter circuit. Both times are sufficiently short not to interfere with the highest sending speeds possible by hand. This "dit" corresponds to about 150 wpm.

a reasonably constant output on all bands.

If variable loading is required, there are two well known ways by which it may be achieved. The first involves a mechanical arrangement which allows the distance between the tank coil and the link to be varied. The objection here is that special parts are required.

The second features a variable capacitor in series with the link and has been included in overseas designs. It has the advantage that the shaft can easily be brought out to a knob on the front panel to give a continuous control over the loading.

The disadvantage is that at the lowest frequency we are interested in, 3.5 Mc, the capacitor value required has to be fairly high in order to have a sufficiently low reactance.

At the highest frequency, 30 Mc, the reactance of the stray capacitance of the tuning gang plus other stray capacitances may be low enough to prevent the loading being reduced. In both cases we are considering a fixed link coil and a line impedance in the vicinity of 70 ohms.

The position can be improved by including a two position switch to reduce the number of turns effective on the link coil and we have seen designs which do just this.

However, we found that it was possible to choose a link coil which will allow the loading to be reduced slightly below the normal on the high frequency band and increased above normal on the low frequency band. For optimum results this coil will require individual adjustment, but you will probably finish with something fairly close to three turns.

The coil should be self supporting and mounted so as not to contact the low frequency coil L2. If you wind L3 over L2, the stray capacitance in shunt with the loading control will make it more difficult to get the required minimum loading at 28 Mc.

This system of variable loading is best suited to an unbalanced output circuit. A balanced version of the circuit would require the capacitor values to be awkwardly high. With this in mind, and the desirability of using an aerial tuning unit in any case, the terminals of the earlier transmitter have been replaced by co-axial connectors.

Balanced ribbon transmission line could be used with the unbalanced loading arrangements. This would result in some radiation from transmission line but in few cases would the effect be serious, particularly as the transmision line is unlikely to be long in terms of wavelengths.

(Continued on Page 119)

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We are pleased to announce a brand new cabinet style suitable for mounting your record player, amplifier, tuner, etc., and storage of records. The cabinet measures 3ft long, 2ft high and 1½ft deep available in timber tones of maple, silver ash and walnut.
The price of this cabinet, polished with two hinged doors and adjustable internal shelf
Only **£20/18/2**

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2. **Universal Output Transformers.** Multi ratio, 5 watt rating can be connected so that any of the following ratios are available, 5000 or 7000 to 2 or 8 ohms and 600 ohm line,
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8. **Short-wave coils** with adjustable iron slug. 16-50 metres. Aerial and Oscillator available. Coil diameter 9/16in. Price only **1/6 ea.**

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11. **Broadcast Oscillator coils**, unshielded, iron cored to suit 1R5, 6J8G, 6AN7, ECH35, etc. Price only **5/6 ea.**

12. 455KC IF transformers. English make. Price only **7/6 ea.**

13. **Dual Wave Brackets.** Well-known make, 13-42 metres and 500 to 1600 KC, new condition. Price only **35/- each.**

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17. **6.5 MC/S IF Transformers** made in U.S.A. Available in sets of 3. Price **19/6 per set.**

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Just landed, another shipment of this popular line. This unit combines a 4½-watt amplifier with two inputs, one for the built-in 3-speed Philips record player and one for a crystal microphone, each input with its own volume control. Also two outputs one connected to the built-in 5-inch speaker and one for a separate extension speaker. The case is finished in two-tone leatherette. Ideal for parties, dances or for playing records in the home. Worth £36/15/-.

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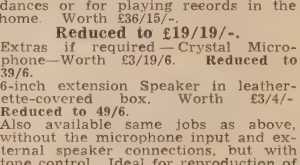
Also available same jobs as above, without the microphone input and external speaker connections, but with tone control. Ideal for reproduction of all types of records. **Price £19/10/-.**



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3-speed Record Player Units co ing of Motor with turnover crystal pick-up, 2 sapphire ne ideal for both standard and m groove recordings, automatic English make.

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Single Speed Gramo motors, r ditioned and guaranteeed in wo order, each motor has magnetic up and automatic stop. Garrard, laro, Paillard, etc.

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Single speed Record Changers. conditioned and guaranteed in w ing order, well-known makes, rard, Collaro, Plessey, H.M.V., St berg Carlson, etc.

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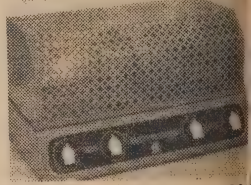

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Amplifier Chassis and metal finished in silver grey hamme with sloping front panel and dial plate, graduated from 0-10 volume controls and treble and controls. Dial plate finished in and silver. This attractive Cabi suitable for 15 to 30 watt ampl Worth £4. Our price £2/17/6. Please send for illustration terested.

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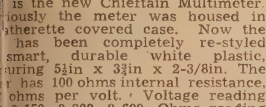
Price only £4/12/6.



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acteristics:—
ment Volts 4
ment Current 1 amp
ie 2 200 volts
1 — 50 volts
neter 90mm
late Sensitivity— 14
ate Sensitivity. 33
ie 3 1200 volts
ro-static deflection
r Green
et connections can be supplied to purchaser.

Cathode Ray Tubes. **39/6 ea.**

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ie 2 135 volts
1 — 20 volts
ie 3 800 volts
ro-static deflection.
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et connections available on re- **Price only 25/- ea.**

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A—U.H.F. Pentode, 6.3 volt fila- Octal base; an excellent tube a.

2-volt detector amplifier triode a.

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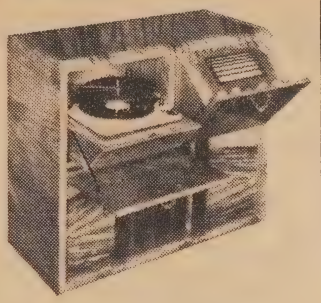

RADIOGRAM CABINETS

As illustrated latest type with slide-out changer panel and tip-out Radio set panel fitted, with velvet action door closer Record storage cupboard. Overall size 35in long, 31in high, and 16in deep. Set panel 16 x 8. Baffle cut for 12in speaker. Changer and set panels uncut. Colors available are Walnut, Mahogany and Blond.

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★ SPECIALS ★

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19. **Output Transformers.** 5000 ohms to 600 ohm line in metal case. Made in U.S.A. **7/6 ea.**

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22. **4 Lug Strips.** 3d ea. **2/3 doz.**

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24. **2 Gang Midget Condensers,** match A.W.A. dial, 12 to 450 P.F. capacity **12/6 ea.**

25. **2 Gang Standard Condensers,** suitable for BC band. Price **12/6 ea.**

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★ SPECIALS ★

29. **Filter Chokes** 80 mA 30 Henry 500 ohms DC resistance. Worth 49/6 Our price **13/6.**

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3/8in diameter, ¾in long with 5/32 Whitworth thread. **1d ea.**
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1in diameter, 1¾in long with 3/16 Whitworth thread. **3d ea.**

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35. **2 Valve Amplifiers,** type A1134, takes less valves, components in each Amplifier, 1-8 pole PMG 3 position toggle switch, 1 2-way toggle switch, 4 transformers, audio input and output, a number of resistors and condensers in a metal box 6¾in x 4¾in x 4¼in. **Price 9/6. ea.**

36. **455 KC IF Transformers,** well-known make, New, Worth 19/6. Our price, only **9/6 ea.**

37. **Coil Winding Wires.** Wind your own coils for crystal, valve sets, etc. Below are listed popular wires and prices per yard. We will forward you whatever length you require

GAUGE B&S	SWG	PRICES PER YARD Enamelled	S.C.E	S.A.S.E.
16	18	5d	6d	6d
19	20	4d	5d	5d
22	23	3d	3d	3d
24	25	2d	2d	2d
26	27	2d	2d	2d
27	29	2d	2d	2d
28	30	1d	1d	1d
29	31	1d	1d	1d
30	33	1d	1d	1d

38. Bakelite former can be supplied cut to the length you require.

Diameter	Price per inch
1 inch	5d
1¼ inch	6d
1½ inch	6d
2 inch	8d
2½ inch	9d
3 inch	10d

39. Aluminium Chassis, large size drilled, 16 x 9½ x 2½in. Sacrificed for **2/- ea.**

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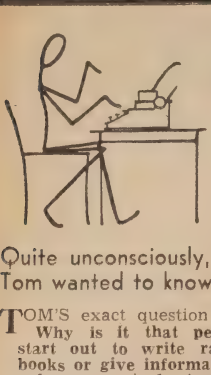
GEELONG MILDURA SHEPPARTON ST. ARNAUD WAGGA WANGARATTA WARRAGUL



Here's your answer, Tom!

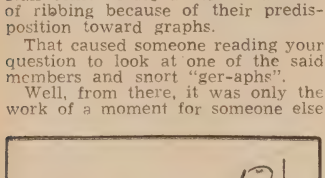
Quite unconsciously, Tom provided us this month with a spot of diversion over morning Tom wanted to know something about the graphs which seem to decorate most radio textb

TOM'S exact question was this: **Why is it that people who start out to write radio textbooks or give information about valves seem to be terribly fond of graphs?**

Well, we must admit, Tom, that there's nothing at all funny about the question and there wouldn't have been—had it not been for the fact that certain members of our staff come in for a certain amount of ribbing because of their predisposition toward graphs.

That caused someone reading your question to look at one of the said members and snort "ger-aphs".

Well, from there, it was only the work of a moment for someone else



A zoological "gi-raffe"

to grab a pencil and draw a radio "gir-affe".

The resulting diagram you can see on this page.

But why are some people so fond of graphs? Well, simply because a graph can give a lot more information in convenient form than any other means of presentation.

The information contained in graphs of valve characteristics, for instance, could be presented in the form of tables of numbers.

The information would be there all right, but it would take a good while to find the particular information one happens to want in the endless lines of numbers.

But there is more to it, Tom, than just reading figures. For example, we know that the plate current of a valve is controlled by its grid voltage and we are often interested in the relationship which the two quantities bear to one another.

If it were purely linear, there would be no special problems, because we could work out the ratio from four figures anywhere in the tables.

Unfortunately the relationship is not constant, or linear, although for certain values of plate current and grid voltages, it does get very close to the mark. For the remaining part, however, the relationship becomes quite appreciably non-linear.

This is of considerable importance because, if a valve is used as an amplifier, any non-linearity results in distortion. To avoid this, the valve must be operated in a region where the relationship of plate current and grid voltage most closely approaches linearity.

To find this region from tables would be an extremely time-consuming process, whereas a graph gives an almost instantaneous picture of the required region, besides indicating the plate current for any particular value of grid voltage.

Plate voltage and plate current, distortion and power output, grid voltage and screen current, or, indeed, any two interdependent valve characteristics, can be illustrated by the use of graphs. And one graph will convey more information, more conveniently, than a bookful of tables.

OTHER DATA

Nor is the use of graphs limited to valve characteristics. The relationship of any two (or more) variables can be depicted with equal ease, be it the temperature of a patient at different times of the day, or the number of eggs laid on a farm, relative to the season, type of mash, color of the hens or anything else you might think of.

Although the subject has been discussed before on these pages, Tom, it may help if we recalled briefly how graphs are arrived at in the first place.

Taking the case of the valve discussed above, we could record the plate current of the valve for any particular grid voltage.

The grid voltage is measured along a horizontal line, divided into equal intervals, each interval corresponding, say, to one volt. The plate current is measured along a line at right angles to the first. Each division on this line corresponds to, say, 10 mA.

If we now mark the measured plate current over the corresponding grid voltage and level with the appropriate value of current on the vertical line—or axis, as it is commonly called—and repeat this operation for varying values of grid voltage, we will have a series of dots representing the relation between grid voltage and plate current.

All the dots connected to with a line will give us a gr the relationship, although it wi rather jerky, because we selected the values fairly far

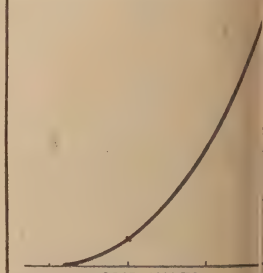
Indeed this procedure is fo by valve engineers, when a valve type is undergoing tests laboratory, the only difference that they plot lots of reference and therefore obtain curves reflect the various current and age relationships very accura

Some of these curves you se lished in valve data books.

And here we leave graph turn our attention to soldering

Some soldering irons tak much as five or six minutes to up. Other irons attain red within a matter of seconds. causes the difference in he times?

The conventional soldering as commonly used for radio depends for its heat on an e current flowing through resi wire. The resistance wire is on a mica former, which is su ed by a brass tube. If the i to be used on 240 volts, the resi wire cannot be accomm in a single layer, and several of fine wire, insulated from



A radio graph

other by more mica, are cor employed.

Inside the brass tube, the or brass soldering bit is inser the whole setup installed in or steel tube which forms the of the iron.

When the iron is switched current first heats the re element. When this reaches 1 the heat slowly penetrates the of mica—mica is almost as g

ator for heat as it is for elec-
y—then the brass former and,
iately, the copper bit. As the
er bit is continuously dissipat-
eat into the surrounding air, it
some time before it reaches
ct operating temperature.
r does all the heat from the re-
ce element reach the bit. A
deal of it is conducted toward
uter tubing, where it is dissipat-
to the air, without ever con-
ting to the heating of the bit.
y take five or six minutes be-
sufficient heat is concentrated
e bit.

ANCING EFFECT

ile this arrangement appears to
ry wasteful of electric power,
ontinuous cooling effect of the
unding air balances the heating
the element and keeps the bit
rature at a fairly constant level,
is very handy in radio work.
wever, such irons are rather
, and almost useless for sub-
ture assembly. Besides, the
g supporting the element also
very hot and can easily burn
unding wiring.
v voltage miniature irons over-
this difficulty. Low voltage,
current elements can be made
small, small enough to fit right
the bit. The low voltage also
its the use of less insulation, a
oating of ceramic or aluminium
on the resistance wire being
ient.
only is the heat developed in
irons where it is needed—in
it — but the thin insulation
s for very good heat transfer
en element and bit.
y little heat is thus lost by
g unwanted metal and, as the
e of the heated parts is very
very little heat is lost by
tion into the air either. As a
, the iron heats up to operating
rature within a matter of sec-

iiature soldering irons require
about one-third of the electric
needed to heat conventional
to the same temperature. The
e is that, for heavy work, the
rcting cable needs to be very
on account of the high cur-
lowing in it, and this sets a
to the use of such irons.
another type of iron with very
heating time utilises the bit
as the heat developing element.
all block of carbon is pressed
st the rear end of the bit, which
y short, and an electric cur-
passed between carbon block
lit. As the junction has a fairly
resistance, considerable heat is
oped in it, aided by small arcs
ng between the contacts due to
e irregularities.

T AT TIP

e again the heat is developed
it is needed—in the bit—and
sses are kept very small. Con-
ntly the iron is hot almost in-
neously.
wever, the junction temperature
y high, and if the current were
continuously, both the bit and
arbon block would soon burn
Such soldering irons are made
a built-in switch, so that the
it is only switched on when
on is actually being used. Con-
sequently, the bit temperature is not constant, but changes considerably.

We can safely say that the larger the size of the heating element, the longer the heating time of the iron.

And from here we go on to transformers. Apparently Tom is having a spot of bother with his.

I built an amplifier which requires 120 mA on the HT line. I could not get a transformer of this rating, only one with 125 mA rating, and the transformer is now getting hot. Could you give me the value of a bleeder resistor to bleed away the extra 5 mA?

At first glance, Tom, we would say, that there is something seriously wrong with your transformer, if it is running hot. "Bleeding away" the extra five milliamps is not likely to improve matters at all. In fact, the added drain on the transformer would make it run even hotter.

You see, Tom, the higher the current drawn from a transformer, the hotter it becomes. The reason for this lies in the internal resistance of the transformer.

Transformers are wound with copper wire and, in common with any other wire, this has a certain amount of resistance. Now the current required for the operation of a radio set not only has to flow through the actual circuit of the set, but also through the winding of the transformer.

PRODUCES HEAT

Thus electric power will not only be dissipated in the external resistance (the overall resistance of the circuit), but also the internal resistance of the transformer. This power is dissipated in the form of heat; that is one reason why transformers get warm in operation.

Looking at it in another way, transformers are designed so that their internal resistance is small in comparison to the resistance of the external circuit. Therefore, the amount of heat dissipated in them is comparatively small.

However, if we increase the current drain through the transformer, which actually means that we have reduced the resistance of the external circuit, the ratio between internal and external resistance will be reduced, and the power dissipated in the internal resistance will rise.

So you can see that bleeding away the excess current would actually increase the operating temperature of the transformer rather than decrease it.

The power dissipated in a resistance does not increase linearly with the increased current but with the square of the current. Thus even a small increase in current can result in appreciable heat being generated within the transformer.

Iron losses in the transformer also have the same effect as winding resistance and, consequently, the higher the iron loss, the more power is dissipated in the transformer itself.

Normally both the winding resistance and the iron losses are kept small for the rated current of the transformer so that, in normal operation, even after several hours, the heat generated is small. One should be able to keep one's hand on it without discomfort.

INTERNAL FAULT

If a transformer gets very hot, even after a short period of operation, the reason is usually some fault internally. Most common fault is a shortcircuit between adjacent turns or between layers on a winding. Both faults would cause the power generated in the shorted portion of the winding to be dissipated within the transformer, thus heating it up. Ultimately this will lead to a complete failure of the insulation between turns and layers and the transformer will fail completely—usually to the accompaniment of blown fuses and much smoke.

Our next question in on the subject of transistors.

Could transistors be used in the building of a shortwave receiver?

The answer is a very definite "No", Tom, at least as far as locally available types are concerned. There has been talk about transistors which perform well up to hundreds of megacycles but there are only a few of them, mostly on the laboratory benches of research institutions.

The average transistor seldom works at frequencies higher than

(Continued on Page 63)

GOING CHEAPLY!

A Queensland reader writes to say that he has a complete I.C.S. Practical Radio Service Course, for which he has no further use. He is quite happy to present it to the first "budding young radio enthusiast" who writes to him and who is willing to pay freight or postage. He will not undertake, however, to acknowledge letters which might arrive too late. His address, Mr. A. Dabelstein, Deakin Avenue. Musgrave Hill, Southport, Qld.

AWA
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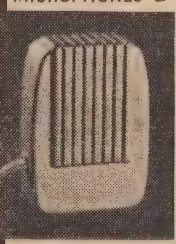
MICROPHONES & ACCESSORIES



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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

ıre Comment on ıminium ldering

wing publication last month of A. M. Fowler's description of ıods of soldering and otherwise ıg aluminium we have some ad- nal comment from another reader, R. W. Knight of 32A Barons Cres- Hunters Hill, N.S.W. The two les provide a valuable reference n this all-important subject.

KNIGHT writes as follows: "Aluminium may be effectively ed without special solder with d of a small tool which can be in a matter of moments."

ıe end of a strip of stiff sheet , such as steel or nickel silver, d to a chisel edge and tinned 50-50 solder." (Although not oned, we assume Mr. Fowler led this to be fitted with a suit- wooden handle, similar to an ıry soldering iron.)

very small amount of ordinary ing flux is applied to the chisel (not to the aluminium) and the nium is heated to the point a large bead of molten 50-50 can be formed on the section tinned.

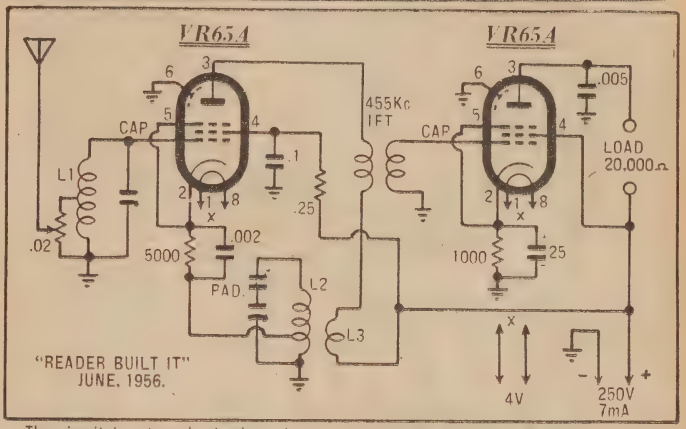
th the chisel edge resting in ead of solder the aluminium is slowly scraped, drawing the ı solder across the aluminium l the chisel edge.

ıe molten solder thus protects ırface of the aluminium from ion, as it covers the metal l the layer of oxide is being ed.

ıen the two surfaces to be are thus tinned they can be wiped with a piece of cloth ning a very small amount of ry flux, then pressed together m the join, more heat being d."

indicated above the main why aluminium is hard to is the fact that it oxidises so y. However, a secondary which causes the beginner a trouble is the excellent heat ıtivity of the metal, which that it is often very difficult ıat a reasonable mass to the ed temperature. The use of a ntional iron on an aluminium s, for example, is quite out of uestion.

application of heat directly job (as suggested by Mr. t) is often the only solution bviously limits the type of which may be undertaken. heless thre are many suitable ts and those who have hesit- ntil now might well reconsider sition.



The circuit is extremely simple and many readers will have most of the parts in the junk box. The EF50 type valve could probably be substituted, even though its gm is slightly lower. Note the use of the old style autodyne circuit.

Small sets are always intriguing and will always have a following of enthusiasts who are keen to extract the last ounce of performance from a minimum number of components. Mr. S. Jorgensen of 1401 Pittwater Rd., Narrabeen, N.S.W. is apparently one such and sends us a very interesting design for a two valve superhet.

THE first valve is used as an autodyne type oscillator and first detector and is coupled to the second valve by means of a conventional 455 Kc IF transformer.

The set is designed around two high-gain sharp cut-off pentodes, type VR65A. These are disposals types, often available quite cheaply, and are the four-volt equivalent of the VR65.

The second valve acts as both second detector and output valve, working into a load of 20,000 ohms. Under these conditions, according to Mr. Jorgensen, the volume is quite sufficient for normal room listening. As would be expected the standard of reproduction suffers a little, but is apparently good enough for the average listener.

One of the main points claimed for the design is the improvement in selectivity as compared to the ordinary run of simple two-valve sets which can seriously limit their usefulness in some localities.

The scheme has also been tried using a pair of 57's and results were quite good but not equal to that obtained with the high-gain valves. This is not surprising when one considers the difference in gm between the two types.

Mr. Jorgensen has also supplied the coil data for those who care to make their own and this is reproduced in the accompanying panel.

COIL DATA

L1 146 turns tapped 30 turns from earth.
L2 92 turns tapped 17 turns from earth.
L3 50 turns wound over insulated from L2.
Wire: 32 gauge enamel. Former: ⅜in diameter.

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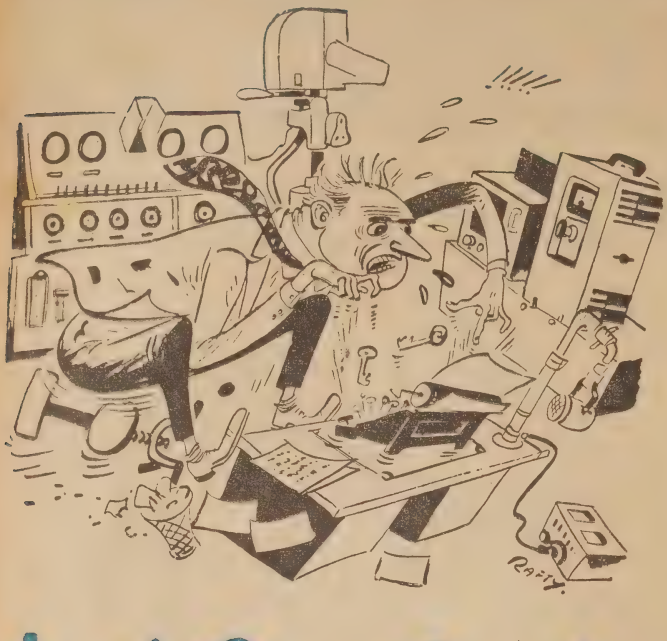


Let's Buy An Argument

From time to time a certain character by the name of Dagwood gives expression to phrase which appeals to me as so simple, yet so forceful. Gazing out of the page to h many readers he remarks, "I hate to see a grown man cry".

by Neville Williams

WELL, I'm a grown man and any-one sitting near me in the train, a few days back, might have seen me emoting in this most unmasculine way.

No, it wasn't over the "discovery" in a newspaper of a remarkable new device (called a transistor) which renders radio valves obsolete!

It wasn't over some new method which would negatise all the laws of physics by presenting true three-dimensional pictures from a two-dimensional medium.

TV AERIALS?

It wasn't over the local introduction of simulated television aerials, to allow "poor" people to keep up appearances.

It was over "Hi-Fi".

As I opened up the morning paper, I came across a Hi-Fi Supplement, with adverts for records, and appropriate little stories sandwiched in between.

There was an explanation of hi-fi for laymen, an explanation so hackneyed that it reminds one of an optician's patter

"Now I want you to look at the letters on this card and tell me . . . &c."

Then there was a graph with a highly ambiguous explanation, which made it appear that hi-fi brings you sounds which the ear normally cannot hear . . . a kind of supersonic hearing aid!

But I was prepared for this.

I was only happy that our long support of the hi-fi cause had helped it to a position where it had become a subject of interest to the man-in-the-street.

Then I turned over the page and (this is where the crying started) discovered the reason for it all.

A large cosmetic manufacturer had released a line of hi-fi make-up!

It stemmed from real "Hi-Fi aches" which television present make-up experts. So ran th planation.

I discovered that, in future wife and daughter must have a Hi-Fi look on their face.

They must wear skirts fro other manufacturer (torren tears) woven with Hi-Fi colors.

And their legs must be en (cries of mortal anguish) in fidelity stockings!

Only one thing was missing: fidential advice to wear "L corsets so as to attenuate the b

ABOUT THE "FLICKS"

While in a mood to complain, revert to a former subject in columns — that of wide-screen tures.

You might remember that we a bit of an argument some time about the likely impact of the methods of theatre presents which were then battling for pa age. I refer to 3D and wide-sc

At the time, I forecast tha would disappear again as quick it had come and that wide-s presentation would be the Fortunately for one's ego, the cast was right but I must confe not foreseeing one unfortunat sult.

The other evening, I noticed a film was showing in a n theatre in "Vistavision." Som the shots from the film had shown quite a while back in the public demonstration of the sy and they were really impressi then presented. A huge screen as well as wide, good definitio excellent photography.

SPECIAL MISSION

So I cleaned my shoes and along to see the complete sho a local (but rather preten theatre.

After the usual procession newsreel, cartoon, first feature lollies-at-interval, I settled bac the main feature, the presentat Vistavision.

I remembered the story o cameras running horizontally, large area negatives, the low content and so on.

You've guessed it! At the c

ent, there was no swinging
of the curtains, no sensation
me huge scene replacing the
of the theatre—just a picture,
lly small in size and not a whit
than the ones that had gone
e.

amount might just as well
saved themselves the bother
to mention my own few shil-
for all the difference their
hed process made to the end
. The picture I paid money
was smaller in size than other
I'd seen in the same place years

i I'm afraid it's not an isolated
What presumably happens is

management is forced by cir-
ances to instal a screen and
to show films in Cinemascope.
me cases, it doesn't cause any
d bother but, in others, the
enium isn't really wide enough.

THEIR BEST

, nothing daunted, they instal
en across the available width
t automatically sets the height
image at something less than
he width. They add masking
top and bottom, provide a
of movable side masks and
ob is done.

y get their Cinemascope, even
oes look like a stage play with
rtain only half-up!

the rub comes when normal
are run through the same
nes. The anamorphic lens is
out of the way and the tradi-
shaped picture appears, only
me height as the Cinemascope
bout half as wide!

completely dwarfed by the
nium and a darned sight
er than it was before they
money on "improvements".

not trying to hit Cinemascope
, nor do I suggest that ordinary
should be blown up to grainy
rosities. (Some of them are
enough already.)

wever, it seems to me that some
expense and manipulation
be justified in such cases to
having half the films look like
nted postage stamps from the
of the theatre!

, it's as bad as television!

NT EXPERIENCE

hold hard, I'm not done with
eatre boys yet.

is it that so many operators
rigger happy" these days, in
t to their gain controls or
s", whatever they choose to
iem?

remark is prompted in gene-
a series of observations but,
rticular, by a further recent
ence.

ing organised to see a par-
film (seems I never go casu-
sat through yet another series
liminary features.

sound was quite normal,
I did not notice that it seem-
taper down during the short
the main feature. It hap-
to be a wide-screen job (pro-
exhibited in this theatre) with
ne" four-track, stereophonic

he title suddenly flashed on
een, the theatre fairly shud-

A SINGLE-SIDEBAND PROBLEM

In view of the article elsewhere in the issue, this letter, which we received some time ago from a Victorian reader, is appropriate. Is he right or is he wrong?

Perhaps you may care to kick the following around a little in "Let's Start an Argument".

There has been much excitement in some circles recently about the use of single sideband suppressed carrier (SSSC) transmission, to be used for, among other things, radio telegraphy. Now I have some ideas on the subject which I don't claim to be original, or irrefutable, but they are the result of independent cogitation.

For the purpose of this discussion let's fall back on the good old standbys, 1000 Kc/s carrier and 1000 c/s modulation. So this is what happens, we are told, in a SSSC transmitter using this frequency setup:

We have a 1000 Kc/s oscillator, followed by one or more amplifying stages, finally feeding to the input of a balanced modulator. Also feeding the balanced modulator is the output of the final modulator, which in turn is fed by 1000 cycles, suitably amplified. Suffice to say that the two frequencies are mixed in the balanced modulator.

The resultant output of the B.M contains the upper and lower sidebands, i.e., 1001 Kc/s and 999 Kc/s, but the carrier frequency is absent. The sidebands are then passed through a filter which removes the one we are not interested in (say the 999 Kc/s one) and passes the required one (1001 Kc/s).

The 1001 Kc/s signal is fed to the antenna and radiated in the usual way.

Now consider the receiver, which for simplicity we will say is a TRF. We receive and tune the signal in the normal way, but prior to detection we re-insert the original carrier frequency, 1000 Kc/s, from a local oscillator, so allowing our received "sideband" to "re-modulate" it. Detection then gives us our 1000 c/s modulation as such.

Well, now, as far as the receiver side of it is concerned, this strikes me as being no whit different from simple CW telegraphy. We receive a signal, beat it against a local oscillator to produce an audible frequency, and detect it.

At the transmitter, we go to an awful lot of trouble with an audio oscillator, sub-modulator, modulator and balanced modulator, merely to produce two CW signals, 2 Kc/s apart, one of which we filter out, the other we transmit. And what we do transmit, I maintain, is nothing more or less than a simple CW signal at 1001 Kc/s. Why not just use a normal CW transmitter operating at 1001 Kc/s.

Well, there's my argument. I could be wrong somewhere. If so, I'd like to know where.

I should point out that I have chosen 1000 Kc/s as a reference merely for convenience, ignoring the fact that it is plumb in the middle of the broadcast band! I have also ignored the fact that a filter to pass 1001 Kc/s and reject 999 Kc/s would be a practical impossibility. Anyway, I'd like to see what this turns up, if only its toes.

(D. B., Essendon, Vic.).

dered to an avalanche of sound. Nor did the operator grab for the control. He just let it play along, showing off his beautiful, multiple amplifiers.

To my own masculine ears, it sounded loud, very loud, but that's all. Masculine ears are like that!

But most of the ladies around about fairly writhed in their seats. Maybe a few of them thought they were suddenly back home again, with their hi-fi husband cranks—or hi-fi crank husbands, whichever way you say it.

I guess they thought similar thoughts.

SOUND CONSCIOUS

Of course, ever since talkies first talked, theatre operators as a group have been sound conscious. Before the war, they were very proud of their multiple speakers and their optical tracks, when most other people could only deal in scratchy records and rather nondescript amplifying gear.

Later, the same operators had to eat humble pie, when domestic listeners got their microgroove records and far better music than ever came off an optical print—well, a rental print, anyway! People even began to make rude remarks about the dull reproduction in theatres.

But now the operator boys are back in the picture again with their high-speed magnetic tracks and their stereophonic sound.

That's fine. I'm all for it. But PLEASE remember those of us who are married; who are trying to educate our life's partner to the fact that hi-fi is more than just a horrible loud noise.

Just after the aforesaid experience, I tackled an operator friend and asked him why "so many of you fellows are trigger-happy?"

His explanation was rather surprising.

He had been instructed to "skimp" the sound on preceding films and to turn it up on the main feature for the sake of impression.

I can only say to operators, exhibitors and others . . . "It impresses all right."

"If you keep it up, I'll only be allowed to see films on condition that they DON'T have "genuine, four-track stereophonic sound".

(Continued on Page 51)

·acos·

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE

DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

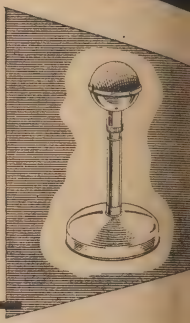
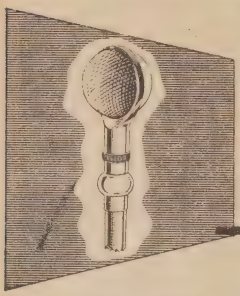


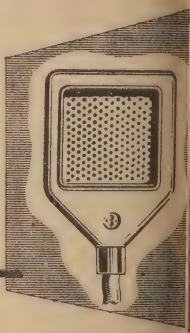
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



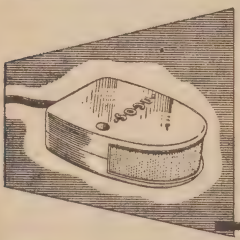
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**

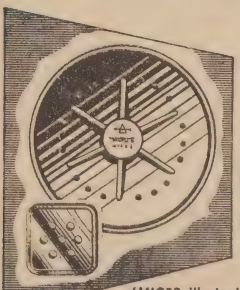


GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**

HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as ⅛ in. square to 1-⅛ in. round, with various thicknesses from ⅛ in. to ⅜ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur broadcasting, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6;** all others, **£1/19/6.**

(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 88 Parramatta Road Camperdown
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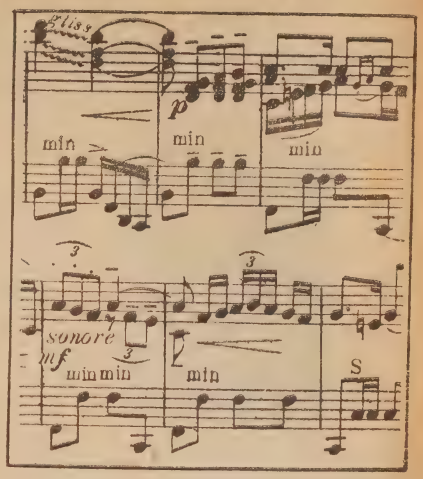
IS THIS GOING OUT OF DATE?

Written music conveys the composer's ideas to a performer but leaves room for much individual "interpretation". The time may come when composers will write their music to feed directly into machines. Or will it? That's the argument.



ring the month I was most in-ted to read that Australian com-r, Percy Grainger, had evolved w instrument which contained 48 vals, or notes, to the octave. It similar in design to a reed n.

ere is nothing very remarkable t this, in itself. Anybody who ed to, with a little imagination, have worked over an old reed n, anytime, to do what Grainger done.

fact, I have seen and heard y reed organs which have used vals, which varied quite mark-from the usual tempered scale. nsert a few more would be no ble at all!

nat I did regard as most inter-g was the statement that the ument could not be played by an hands but that it would pro-its music directly from paper hs.

CHANICAL" PROCESS

many people, this will immedi-banish the device to the same cal Hades as player pianos, n organs, music boxes and other es which produce their melodies out the direct intervention of a er—I mean right there, on the

put the notes straight on a n, then feed them into a mach-o be played, smacks of mechani-n in its worst form.

is to a musician what a camera an artist!

t I wonder have you ever real-that ordinary music is a kind of nical notation in itself—and a un-precise kind at that!

ink of it this way:

composer sets out to record for rity, the message, the emotions s musical mind. Traditionally, is only one way to do it . . .

ne use of conventional musical ion.

places little blobs on the paper, position indicating pitch, their arance indicating duration.

adds bars and things to de-e the basic tempo but, to prevent esult from sounding too mech-l he is likely to add certain s and signs here and there to ate some slight variations there-

en there is the matter of loud-Here again, the composer re-to words and signs to indicate ntentions—loud here, very loud ; softer, very soft; diminishing, asing, and so on.

t it is safe to say that, even after omposer has exhausted all the s and notations at his disposal, en a supplementary explanation, ou like, the conjurings of his have not been recorded with-mbiguity.

RENDITION

ng comes a player or conductor t as an agent, by which the ions are transformed into actual

u may sit in the audience and what you hear, but you are not sarily hearing what the com-originally intended that you d. Certain subtle shades may been lost altogether because of limitations of his "graphical" d.

yet again, the conductor or r may deliberately take liber-with the said notation and pre-sent the listener with what he thought the composer meant, or what he thought he should have said.

Hence all the likes and dislikes about various "readings" or "interpretations" of great works.

It's all a matter of whether you set your star by the composer, by the particular player, or by the separate inspirations of the two in cohort.

But why should we limit a composer, by our traditional thinking, to traditional methods of recording his thoughts for posterity.

Why should we deny him the right to avoid the limitations or ideas of professional musicians. After all, from the composer's viewpoint, they might easily be considered as just a medium by which his thoughts are transferred to a listening audience.

It depends on the magnitude of his ego.

If he can learn to write down his music in another form, then why not do it?

Especially if that form can be a continuous graph, showing at all times the exact relative level, the exact rate of diminish, the exact degree of hang and hesitancy and so on.

And having done all that, why not feed it into a machine and let the music be produced directly.

SYNTHETIC PROCESS

It might be quite impossible to draw actual wave shapes, but it would not be impossible to synthesise quite complex tone combinations by electronic aids. Already RCA engineers are playing around with such ideas.

There is no special reason why a composer, who knew what he was about, should not set up a machine so that it would synthesise a chording containing so many fundamentals, a particular harmonic structure on each, with individual attack and delay times, if you like, and as much other complication as you might demand.

(It still would be no harder than compatible color TV!)

Then he might press a button and, presto, a single complex wave shape would emerge, containing ALL the information which he had preset at his leisure.

Keep on doing this long enough and you have lots of chords.

String them together and you have a complete composition with sustained, intermittent or solo signals running through it, just as you might choose.

It would not require the intervention of a human player at all to transcribe to actual sound.

If it should sound "mechanical", that's a matter for the composer and his capacity to use the particular method.

Quite naturally, he could and probably would produce sounds and cadences which were foreign to conventional music, sounds which might defy a human player to produce, using such instruments.

TO BE EXPECTED

But is that not to be expected?

Time was when man's only available means of making "music" was with his vocal chords.

Then he learned to make suitable noises by hitting, plucking and blowing various mechanical devices.

He learned to use both hands, where necessary, but he was not satisfied.

A composer of organ music now demands that his performer use both hands and both feet, performing multiple functions with them, into the bargain!

Is this the end? Must a composer thereafter resort to duo rather than solo compositions? Or should we seek to breed a race of tri-dextrous "humans". Or should we concede composers the right to eliminate the musical mechanics altogether from the scheme of things and compose directly for machines?

On second thoughts, perhaps I should withdraw and apologise for that term "musical mechanic", but then it's such a beautiful insult that it's a pity to spoil it. So let's leave it, shall we? But then, maybe, there are readers who regard certain musicians as "mechanics". Perhaps a musician should be a mechanic?

But I've just had a horrible thought. The designer of an electronic music producer (score-to-sound type) could put in attack and decay controls, &c., which would be even more potent in the hands of the listener than a modern "tone" control!

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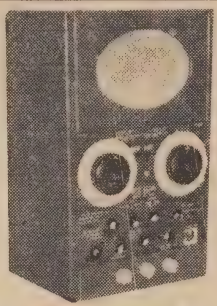

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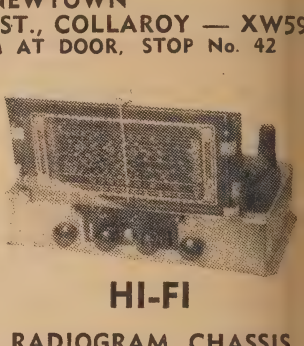

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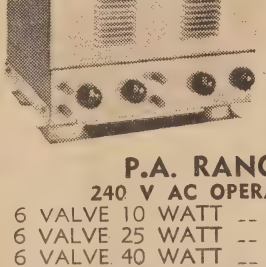

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ROM THE SERVICEMAN WHO TELLS

way of the unusual this month I have a tape recorder which wouldn't record, an open cuit speaker transformer which still worked and—of all things—an intermittent in my own amplifier. The last-named was almost more than I could take.

e recorders are not, as a rule, in my line. I am familiar he general principle of opera- f course, but one needs rather than that to tackle servicing rofitable basis. The mechanical is in particular are as varied igns for dial mechanisms — ven more complicated.

things considered I usually steer these devices back to the s. Not only should they know e answers but they should ave adequate stocks of the s levers, cams, bushes, &c. it which it is impossible to an effective repair to the nical system.

f BIRD

when I found a customer wait- t the doorstep on opening up orning, carrying such a de- nd looking very worried, I overkeen on becoming in- with it. I wanted to have a lea of the nature of the fault, promising that I could help. ponse to my queries the cus- came out with a real tale of

eems he had borrowed the in- nt to make some recordings nusical group to which he be- and had gone to considerable e to organise an evening at the recordings were to be

gine his mortification and dis- therefore, when the thing refused to record a note. Mor- on because he had called to- a whole group of artists for g and the whole program have to be organised again, istress because he feared he broken" the recorder which ed to someone else. gether he gave me the impres- f having spent a very restless

HANICAL DETAILS

first thing I wanted to know hether the mechanical side of evice still worked. Did it still and re-wind, did the various ary devices, such as brakes ressure pads, appear to work tly, and so forth.

the tape would run in either ion as he imagined it was sup- to do, and there didn't seem anything silly happening which suggest mechanical troubles. wouldn't record.

e he was so distressed about hole thing and the trouble d to be purely electrical I would have a look at it for After all, it could be some- quite simple.

e careful questioning brought it the fact that it did, in fact, o record but extremely faintly. ich so that it was necessary to intently right at the speaker

to detect anything. More than that he was unable to tell me.

After he left I studied the device in greater detail. Almost immediately I noticed that the tape was running past the head with the dull (active) side away from, rather than against, the gap. While my first impression was that this was the answer to the problem, more careful examination caused me to have second thoughts about it.

I couldn't be sure, for example, whether the tape as it was threaded at the moment was as it had been when the device failed or whether the user had been fiddling with the reels after it failed. I was prompted in this latter thought by reason of the rather unusual reel arrangement.

As far as I could see the tape was intended to come off the reel shiny side out and wind on to the take-up reel dull side out. While somewhat unconventional there was no real objection to the idea (no pun intended!) since the device was a single full width track and there would not normally be any reason to transpose the reels.

LIKELY MISTAKE

On the other hand an unskilled operator could easily get into strife if he decided to transpose the reels for any reason.

Having threaded the tape correctly I set things in motion. There was plenty of material on the tape, both speech and music, but I had no means of knowing whether any of it was the program which my customer had tried to record. If it wasn't, then the device had failed to record. But if it was, then the device had recorded but failed to playback. Since it was playing back now I could only attribute such a failure to an intermittent or gross mishandling by the operator.

The next thing I noticed was the pressure pad intended to hold the tape in intimate contact with the head. Although it moved correctly from the "off" position, as for rewinding, to the "on" position when recording, it did not seem to be exerting any pressure on the tape. In fact, there was quite a discernible gap between it and the tape, when one looked closely.

The pad was on the end of a spring leaf extending from a lever which protruded through a slot in the panel from the works underneath. Due either to abuse or to the fact that it had never been correctly adjusted, this leaf was wrongly set, so that it could not exert the required pressure. While not sufficient in itself to prevent recording it would not improve the final results.

A few minutes with a pair of pliers was all that was necessary to correct this fault, leaving only one question to be answered: would it record? Searching through the tape I found a section on which the program material did not seem to be of any particular value, switched to record, and muttered the old "one, two, three, &c. . ." ritual into the microphone

On switching to playback everything seemed to go according to plan; the old recording had been completely erased and my own recording was there in its place—even if a little on the weak side. Further experiments established that there did not seem to be much reserve of gain, it being necessary to have the gain control nearly "flat out" to get a reasonable depth of recording, even when working close to the microphone.

NOT THE FIRST

Whether this was normal for this particular machine I had no means of knowing, though it was not the first recorder which I had encountered which had this characteristic. Apparently some manufacturers are afraid to provide too much gain for fear that unskilled operators will run into strife with gross overloading of the tape—not to mention hum problems when playing back.

In this case the microphone was a dynamic variety of a type which I knew had only a moderate output. I happened to have on hand a good quality crystal type with a similar fitting on the end.

It took only a moment to swap them over—and what an improvement! There was now gain enough and to spare, and I imagined the quality was better also. Was this just good luck, was the dynamic mike faulty, or was it the wrong mike for the device anyway? Once again, I had no means of knowing.

The only other point that struck me was that the quality was not as good as I imagined it should be. While my experience is limited, it seemed to me that others of similar style which I had heard were capable of better results.

This could be due to a number of reasons, including the design, but on a sudden impulse, I unthreaded the tape and examined the record-playback head. While the gap was only faintly visible the point that struck me was the shape of the polished area of the head, representing a certain amount of overall wear.

CHECKED THE HEAD

This was not symmetrical, being wider at the bottom than at the top, and suggested that the wear was uneven. I can only assume it was due to mis-alignment of some kind or uneven pressure on the head. Anyway, the point was that the head was not only fairly well worn, but probably worn unevenly into the bargain. The result could only be a substantial loss of high note response.

Summing up, it seemed fairly obvious that the main cause of failure was the incorrectly threaded tape. In addition, there was the faulty pres-

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pad, a microphone which didn't
ar to be suited to the job, and a
showing unmistakable signs of
Altogether a rather formidable
f faults.

en the customer came to collect
ecorder I tackled him about the
bility of the reels being trans-
and also the unsuitability of
ike. Regarding the reels, he
t quite sure, but agreed that it
have happened while he was
g the thing up. He certainly
checked the point!
s, along with the facts I have
ly enumerated, clinched the
r in my own mind.

STORY

the matter of the mike he was
more helpful. Yes, it was a
tute mike, one he normally
on a PA system. Since he had
ilable he had borrowed the re-
without its microphone, ap-
ly on the assumption that one
was very much the same as
r.

er I had explained the whole
to him he was obviously con-
bly relieved to know that he
"broken" a borrowed record-
lso advised him to obtain the
phone belonging to the re-
, explaining that it should give
sensitivity and quality. Fin-
suggested that when he re-
the recorder to the owner he
in that he needed to have
iced and that this had revealed
evidence of wear in the head.
uld, therefore, be a good idea
ve this point checked by the
s.

so he went on his way happy
thought that his next attempt
ording had a reasonable chance
ng successful.

on't know whether there is
of a moral in the above story,
, perhaps, that devices like
ecorders need to be really fool-
since they are so frequently
by persons in all walks of life
only the vaguest idea of
ney operate. Things which the
e enthusiast would take for
d, such as the right and wrong
of the tape, are perfect traps
e non-technical.
aps a warning printed on the
near the head might help to
confusion of this kind. Any-
pass the idea on to the re-
manufacturers for what it is

FICIAL JOB

next story is one of those
ial incidents which happen
normal working hours. In
cases they provide better copy
he run-of-the-mill jobs in the
op.

ppened to drop in on a friend
studying radio at one of our
l institutions and who spends
of his spare time fiddling with
n set or even doing a spot of
servicing when it comes his

lough such servicing activities
cessarily limited, he is getting
l of sets in general and is in
ocess of building himself a
eter. When this is complete
e has acquired a little more
ence, he will probably be able
e problems like this one in
side. Just now, however, they
mighty puzzling.
're just the man I want to
see," he exclaimed, after we had exchanged preliminary greetings, "I have a set here I'd like you to have a look at. It's a bit tough for me."

So saying he led me into his loungeroom, which looked more like a workshop. (What an understanding wife he must have). Spread out on the floor was the offending chassis — a mantel set — the partly completed multimeter, a couple of boxes of bits and pieces, a soldering iron and the paraphernalia which goes with it.

We squatted on the floor like a couple of fathers playing with a toy train and proceeded to examine the chassis. "Main trouble," said my friend, "is that this resistor gets hot —very hot."

"This" resistor was a 3 watt wire wound type with one end obviously earthed. The other end connected to a lead which disappeared into the power transformer and also the negative end of one of the electrolytics. I couldn't see the value but it was pretty obvious that it was a back-bias resistor of some kind.

"My friend," I said, "unless I am very much mistaken you have a HT short somewhere in the system. Most likely one of the electrolytics."

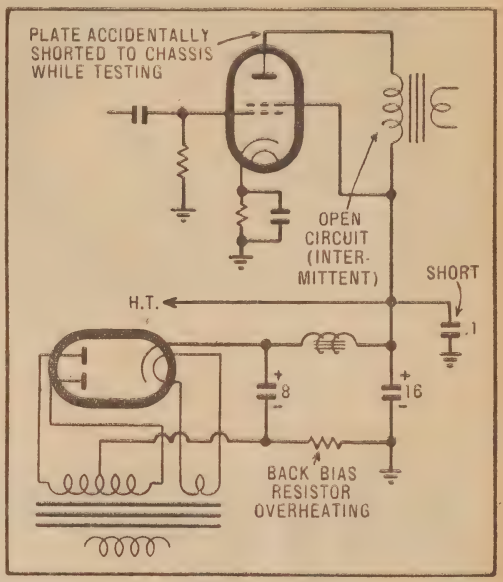
"The electrolytics are both new," he countered. "Could they still be faulty?"

I agreed that it was unlikely, though not impossible, and suggested that a paper bypass was a more likely culprit. In any case, it was obvious that we were going to need a meter of some kind in order to get very much further. It transpired that my friend's multimeter had reached the stage where all the ohms ranges were working, and I reasoned that this would be all that was necessary.

I didn't take long to find that there was only a few hundred ohms from the HT line to chassis and that it was lowest on the second electrolytic side of the choke. At this point I could see that some leads would have to be undone before the real culprit could be found, but while the iron was warming up, I prodded around in the hope that I might yet strike a clue which would save the bother of undoing joints.

In the process I happened to measure the primary of the output transformer and was surprised to find an open circuit. Doubtful at first that I had identified the leads correctly I checked and double checked. There was no doubt about it, the winding was completely open, not even the highest range giving it a flicker of continuity. In view of what subsequently happened I was glad I had checked this point so carefully.

Two faults in the one set were too much for a beginner! The shorted .1 mfd caused the back bias resistor to overheat while an intermittent speaker transformer caused intermittent distortion. Accidental application of the HT voltage directly to the winding effected a temporary "cure".



So now there were two faults, and my friend was somewhat relieved to learn that he had not been tricked by such a simple fault after all.

When the iron warmed up we lifted a few connections and soon isolated the .1 mfd HT by-pass as the cause of the bother. At this point I decided to leave the job to my friend. Fitting a new .1 mfd did not present any problem and he thought he had another output transformer somewhere which would at least serve temporarily.

All things considered there seemed no reason why the job was anything more than routine from this point on.

SIMPLE FAULT

When I finally took my leave my friend went off to his junk box to fish out another transformer and try his hand at getting the set going again.

I hadn't been home long when the phone rang. It was my friend. "Something funny going on with this set," was his opening remark, "I replaced the condenser and it works with the old transformer."

My immediate reaction was that I had, after all, made a mistake in checking the transformer, though I was at a loss to understand how.

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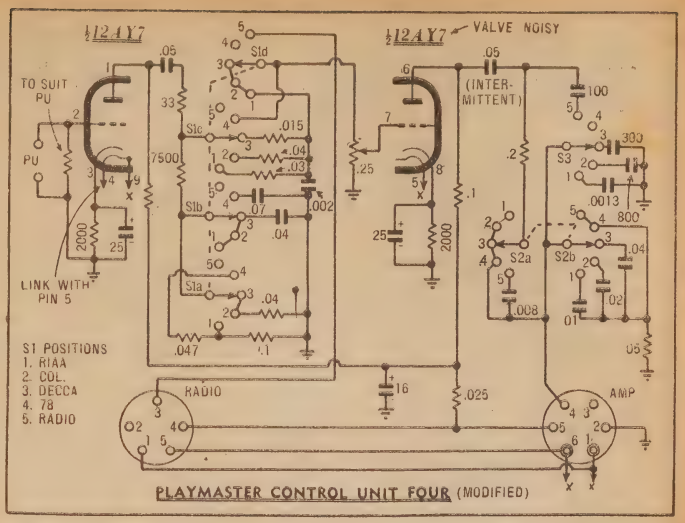
Have you checked the trans-
ier?" I asked.
Yes, and I still can't get a read-
But the set works."
Now, wait a minute——" I com-
ced, being quite unable to accept
a contradictory set of circum-
ces.
Oh, there's one other thing," he
rupted. "The signals are very
orted."

PIRATION

iddenly the light dawned. May-
I was only making a shrewd
s but I felt pretty sure I was
t. The fault in the transformer
of such a nature that it regis-
t open circuit on the ohmmeter
here the voltage involved was
e low—but was at least par-
y conductive at the higher volt-
encountered when the set was
ing.
this were true, it was possible
the voltage applied to the plate
ld be lower than normal, thus
unting for the distortion, yet
enough to allow the set to work
I hoped, to protect the screen
excessive dissipation.
explained this to my friend and
ested that the safest thing
d be to simply replace the trans-
er and cut his losses. How-
, if he was keen to confirm my
nosis he would need a volt-
r so that he could compare the
voltage with HT voltage. If
as right the former would be
lower than the latter.
didn't have a voltmeter but
ew that his multimeter was all
to receive the voltage multi-
s just as soon as he could get
of suitable high stability types.
refore suggested he wire a .25
resistor into circuit temporarily,
making a 250 volt range of
cient accuracy for the purpose.
d he manage this?
s. he thought he could, and he
up with a promise to ring me
and let me know the result.
lf an hour later he was back,
puzzled than ever. It seemed
he had managed to rig up a
meter and set about measuring
voltages as I had suggested.
fortunately the results were
nclusive" as they say in the
scientific papers, since, in try-
o measure the plate voltage the
prod had accidentally shorted
e end of a condenser (I assume
as an earthed end), there had
the usual "splat", and the dis-
on had vanished.

FUNNY

hat was more, my friend could
observe a continuity reading
s the output transformer. To
it was getting past a joke.
t, as far as I was concerned,
tory only served to confirm my
nal guess. In shorting the plate
rth my friend had accidentally
d a trick that used to be quite
lar in the old days. The gen-
a idea was that a transformer
h was intermittent could be
d" in one sense or the other
plying the full HT voltage to it.
e result was either to weld to-
r the broken wires, thus curing
rouble, or completely burn out
intermittent so that the trans-
er was useless. Either condi-
was regarded as being better
the previous doubtful one.
Evided the idea was used as an
gency cure only and was fol-



PLAYMASTER CONTROL UNIT FOUR (MODIFIED)

Together with a noisy 6AU6 in the main amplifier these faults in the control unit caused plenty of bother. The intermittent coupling capacitor was the last straw and caused severe changes in level as well as noise.

lowed up with a regular transformer replacement the trick was quite a handy one. But, as a cheap way of supposedly effecting a permanent repair, I'm afraid I cannot give it my blessing. There is far too much risk that a transformer already suffering from internal troubles will continue to suffer from them. Far better to scrap it while the chassis is out of the cabinet.

Having explained most of this to my friend he was considerably less puzzled by the whole affair and went back to the set with the avowed intention of taking my advice and replacing the transformer.

Assuming my diagnosis was right what is the usual cause of failures of this kind ? Anyone who has ever stripped down a faulty transformer will probably know. The point of failure will inevitably be found in a small patch of green corrosion — commonly known as verdigris.

This, in turn, may be due to a number of causes. An extreme case would probably be the careless handling of flux by someone in the vicinity of the winding machine. Even so-called "non-corrosive" fluxes will attack metals like copper if given long enough, and, once wrapped up in a winding, it is only a matter of months before the winding fails.

Another cause is a spot of chemical impurity in the interleaving paper, something which even the most efficient quality control system can overlook.

Again, it could be due to careless handling on the part of the winding operator. Even perspiration from the fingers can contain enough corrosive chemical to eat away the fine copper wire used in such windings and operators are not supposed to handle the wire during the winding operation. Of course this is sometimes unavoidable, and a possible doomed winding results.

And in all the above cases the condition is usually aggravated by the presence of voltage across the winding resulting in electrolysis, really a speeding up of the normal chemical action by the presence of a potential difference.

So there it is. As I said at the beginning, I am only making a shrewd guess as to what really happened

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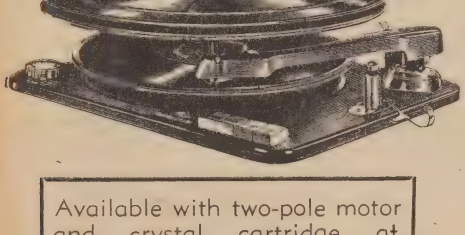

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there is no chance now that it ever be proved either way. But how I think I was right.

ming even closer to home — my e to be exact — I have had a of amplifier trouble over the few weeks. Apart from the fact I have encountered a whole s of irritating faults which, in , was getting me down, one of turned out to be a cranky in- ittent which — but perhaps I better start at the beginning.

y outfit consists of the No. 9 master amplifier and what is ally the No. 4 Control Unit. I "virtually" because I have ked about" with the circuit a to make it suitable for my own irements, though nothing of h the Technical Editor would approve.

OD SET-UP

is a very nice set-up and, to- er with the best associated items n afford, satisfies my require- ts for the time being. At least es so when it is working proper- When it isn't it causes me more yance than a whole day's work ar radios.

so, like the plumber who al- ; has more dripping taps in his place than in his customers', afraid it often takes me longer it really should to get around xing my own gear. The point suppose, that I get paid to re- other people's sets, but I have o my own for nothing!

all started not long after I built control unit. The 12AX7 turned o be microphonic and gave rise nsiderable bother. I don't know her it was appreciably worse the average for this type but it far from satisfactory in my par- ar set-up.

is may be due in part to the that I have my entire outfit, in- ng the speaker, housed in the large cabinet. Oh yes, I know it right Mr. Technical Editor, but try convincing Mrs. Service- that the artistic layout of her geroom would be improved by addition of vented enclosure. At it will have to stay that way I can produce an enclosure h is aesthetically acceptable.

the meantime I had to do some- about the microphony. First ied several other twin triodes as the 12AT7 and the 12AU7. were not much better and the lem was still serious.

en I happened to mention my ble to a colleague. "What you is a 12AY7, old man. Wonder- valve. Absolutely silent as the e. Bit pricey, but well worth it."

OULD BE QUIET

rther checks confirmed his re- s. The 12AY7 is a specially de- d low-noise twin triode, having derate order of gain somewhere een the 12AT7 and the 12AU7. culated that I could stand the r gain if only the thing would in quiet.

I purchased a 12AY7. As my ague said, it was a bit pricey, than twice the price of a nor- valve, but I paid up gladly. fully I plugged it in and ran v preliminary tests. There is no t about it, it was really quiet I believed my troubles were

t not for long. The new valve had not been in operation for more than a few hours when the set began giving forth horrible hissing and spluttering noises. A few preliminary tests narrowed it down to the control unit and simple substitution showed the precious 12AY7 as the culprit. Yes, believe it or not, the supposedly silent valve had become exceptionally noisy within only a few hours of being put into service.

MORE TROUBLE

More than a little annoyed I speedily returned it to the local agents (it is an imported type) with a please explain and, in due course, received a replacement valve. Keeping my fingers crossed I plugged this in and tried again. Once again results were very good and after a couple of days without incident reached the stage where I could listen in a reasonably relaxed mood.

Just when I was beginning to enjoy the programs without consciously worrying whether something else was going to blow up, another burst of hiss and crackle put me right back where I started. With visions of another 12AY7 on the blink and more red tape and paper work to secure a replacement I was hardly game to start looking.

However, I needn't have worried—the trouble turned out to be in the main amplifier and I'm afraid that as soon as this point was established I turned automatically to the 6AU6. I was right, too. It was as noisy as they come. This is nothing really unusual and is the reason I turned to it so readily. Although no one seems to know why, this is one valve that seems to defy the efforts of all manufacturers, both local and overseas, to make really quiet—at least for low-level applications.

With a new 6AU6 in place most of the noise vanished, but there was still a faint background which worried me somewhat. I let it go for a while, hoping that it might clear up of its own accord. Instead, it became worse and eventually deteriorated into something far worse than all my previous troubles.

INTERMITTENT

It was no longer simply noise, but a definite intermittent condition affecting the signal level. Usually to the accompaniment of a particularly vicious burst of noise, the level would drop appreciably, probably 10 db or more, while the quality became thin and reedy.

I found that the original condition could always be restored by withdrawing the power plug for a second, the volume coming back to normal when it was replaced. This was all right once in a while, but it becomes a bit monotonous after a time and, as the trouble became worse day after day, I decided I couldn't put it off any longer.

I soon established that it was not in the main amplifier and, further, that it was in the second half of the control unit, since the trouble was common to both radio and pick-up. So, once again, I dragged the control unit out of its case, opened it up and commenced to probe its innards.

I replaced the 12AY7 with others which, even if they were microphonic, were not noisy or intermittent. The trouble persisted, thus absolving the 12AY7. I put it back and continued my search. Considering the violent nature of the fault

Mantovani

records for

DECCA

Mantovani's Orchestra in Exclusive Decca Full Frequency, Hi-Fidelity, L/P Recordings.

The Mantovani style is lush, sophisticated and subtle. Decca records a large range from this most popular Light Orchestra

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PREFERRED TRANSFORMER RANGE

POWER TRANSFORMERS FIRST PREFERENCE

CODE NO.	PRIMARY VOLTS	HTV Aside	HT MA	FILAMENTS
PF 130	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 130F	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 151	230-240	285	60	6.3V/2A 5V/2A
PF 151F	230-240	285	60	6.3V/2A 5V/2A
PF 152	230-240	285	125	6.3VCT/2A 6.3V/2A 5V/2A
PF 165	230-240	385	60	6.3V/2A 5V/2A
PF 170	230-240	285	80	6.3V/2A 6.3V/2A 5V/2A
PF 185	240	150	30	6.3V/2A
PF 201	240	225	50	6.3V/2A
PF 265	230-240	Secondary Volts		17 TAP 11.5, 10. 8.5/4.2A
PF 299	240	285	40	6.3V/2A 5V/2A

POWER TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIMARY VOLTS	HTV ASIDE	H.T. MA	FILAMENTS
PF 160	230-240	385	100	6.3V/2.5A 6.3V/2.5A 5V/2A
PF 164	230-240	325	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 166	230-240	325	60	6.3V/2A 5V/2A
PF 168	230-240	385	80	6.3V/2A 6.3V/2A 5V/2A
PF 169	230-240	325	80	6.3V/2A 6.3V/2A 5V/2A
PF 173	230-240	425	175	6.3VCT/3A 6.3V/2A 5V/2A
PF 174	230-240	285	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 175	230-240	385	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 545	240	Ext. 1000	2	6.3V/3A 6.3V/6A
		350	20	4V TAP 2.5/2A
PF 439	240	32V	60	240-32 STEPDOWN

POWER CHOKES FIRST PREFERENCE

CODE No.	HY IND.	D.C. RES.	D.C. MA
CF 102	15	300	60
CF 103	30	420	60
CF 105	15	250	80
CF 109	20	225	150
CF 196	20	130	125

POWER CHOKES SECOND PREFERENCE

CODE No.	HY IND.	D.C. RES.	DC MA
CF 106	12	200	100
CF 111	16	165	200
CF 112	10	70	250

If you have difficulty obtaining regular supplies, contact us immediately.

OUTPUT TRANSFORMERS FIRST PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z.	RESPONSE
OP 9	15	10,000, 6600. 5000 PP	500, 250, 125	50-8000 C/S
OP 13	25	10,000, 6600. 5000 PP	500, 250. 125	50-8000 C/S
OP 24	5	5000 SE	8.4 OR 2.1	30-15,000 C/
OP 25	15	10,000 PP	15-3.7 OR 8.4-2.1	20-30,000 C/
OP 44	10	5000-2500 SE	500, 250. 125	50-8000 C/S
OP 54	10	5000-2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	50-8000 C/S
OP 58	15	10,000, 6600. 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	50-8000 C/S
OP 63	15	10,000 PP	15, 3.75	30-15,000 C/
OP 112	6	10,000 PP	2, 8	40-12,000 C
OP 113	6	5000 SE	2, 8	40-12,000 C
OP 118	6	8000 PP	2, 8	40-12,000 C

SUIT ROLA 12 OX

OUTPUT TRANSFORMERS SECOND PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z	RESPONSE
OP8M	15	10,000 PP	500, 250, 160, 125, 100, 83.5, 7., 62.5, 55, 50	50-8000 C/S
OP 17	32	10,000, 6600, 5000 PP	500, 250,125	50-8000 C/S
OP 19A	15	5000 PP	12.5, 8, 2.3	30-15,000 C/
OP 65	15	10,000 PP	8.4, 2.1	30-15,000 C/
OP 67	15	5000 PP	15, 6.5	20-30,000 C/
OP117	6	5000 PP	8, 2	40-12,000 C/
OP119	6	6600 PP	2, 8	40-12,000 C/
OP 60	32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	50-8000 C/S

VIBRATOR TRANSFORMERS FIRST PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC
VT 104	6	250	60	.004
VT 210	12	250	60	.006

VIBRATOR TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC
VT 116	24	250	60	.005
VT 208	6	250	60	.01
VT 209	12	250	60	.08
VT 211	32	250	60	.005 ea. hal

FERGUSON LANE CHATSWOOD

FERGUSON

TELEPHONES JA 0497 (6 LINES

Engineered TODAY for TOMORROW'S requirements

the change in response I con-
ed the most likely culprits to
he cathode bypass or the grid
ling condenser.

the same time I didn't overlook
ossibility of a resistor going high
mittently. But the real snag
to check all these components.
e apart from the fairly compact
re of the unit there is the prob-
of hum once the box is opened
particularly when attempting to
k components while the system
nning.

ISTORS CHECKED

spite of this I managed to check
resistors most likely to cause
ble, partly by means of the ohm-
r—wiggling them around while
s connected—and partly by tap-
them while the system was
ing. I finally decided that there
't seem to be anything wrong
is direction.

xt the condensers. Of the two
likely offenders the grid coupler
ed the best bet; besides, it was
st to get at. Accordingly, I took
asy way out—I simply changed
I figured that the trouble was
ad that I would know immedi-
if I had effected a cure.

was very encouraged, therefore,
the system warmed up again
appeared to be perfectly quiet.
, a couple of hours later, it
still running quietly with per-
ance normal in every other way,
t 90 pc certain I had hit it.
after several days of trouble-
running, I am fully convinced.
for the exact reason why the
enser behaved as it did. Well,
uldn't presume to know the full
, though the symptoms are com-
enough, I fear. It is fairly obvi-
ous that the thing was going open circuit, or partially so, thus causing the drop in both level and bass response. The really puzzling aspect is the reason why it could be restored by a surge such as that produced by switching on and off.

Not that this effect is in any way unusual. I must have encountered literally hundreds of such surge sensitive receivers over the years and in almost every case it was a paper condenser.

Ever pulled one of these things to pieces and examined it carefully? If not I suggest you try it; the result may surprise you. How, for example do you imagine the pigtail is connected to the ends of the foil? Riveted? Welded? Or soldered, in spite of being aluminium? No, my friend. None of these. Just a simple "pressure" joint consisting of a flat spiral of tinned copper wire, which ultimately forms the pigtail, pressed against the loose ends of the foil winding.

MECHANICAL JOINT

What's more, the only thing that holds it in place is the outer casing, whether it be of moulded material, cardboard or what have you. Small wonder, then, that this joint can give so much trouble and that paper condensers seem to be one of the weakest links in our chain of components these days.

With TV on the horizon perhaps it may be opportune to suggest that better quality, even at a higher price, would be acceptable to the trade and public generally.

I imagine TV receivers are going to be tricky enough, anyway, without tracing intermittents in them!

HERE'S YOUR ANSWER, TOM!

(Continued from Page 45)

to 500 Kcs, so that it is not
suitable for broadcast fre-
ncies. The frequencies encount-
in short-wave reception are
er still, so that there is little
for a transistorised short-wave
ver just yet.

one compares the transistor
the conventional vacuum tube,
reason soon becomes obvious.
e is a vacuum, or literally
ing, between the electrodes of a
um tube to impede the flow of
rons. Their speed therefore
ly depends on the operating
tials.

the transistor, there is solid
er between the electrodes, and
rons, or their positive counter-
s, the "holes", find the going
mely difficult, having to dodge
atom after the other. As a
t, their progress from one
rode to another is comparative-
ow.

e point is that the electrons
to reach the attracting elec-
e before the signal voltage on
control electrode completes one
ter of a cycle. At audio fre-
cies this does happen in the
istor but, as the frequency of
signal becomes higher, a stage is
hed where the signal voltage
ally reverses on the control
rode, before the electrons reach
attracting electrode.

This, of course, means that they are just jerked back and forth, never actually flowing through the external circuit. They, therefore, cannot produce an amplified output.

This "transit time" effect also occurs in vacuum tubes, but the frequency limit is far higher, so that it does not become noticeable until the upper end of the VHF band is reached.

TV on moon

UNMANNED rockets equipped with TV transmitters would reach the moon within the next four or five years, Moscow Radio predicts.

In a broadcast it quoted a Moscow Observatory lecturer saying that such rockets, equipped with television transmitters, will make possible a detailed study of conditions met in space flight.

The broadcast added, "As soon as the moon has been explored the launching of manned rockets and the establishment of a permanent scientific station on the moon will become a reality.

"A little later—between 1965 and 1970—exploration of Mars and Venus may be expected to start."

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

MODEL E15 FEATURES: Eight valves, world range—A high gain R.F. stage which ensures satisfactory long distance reception regardless of location —Push-pull output—Inverse feed-back — Radio-gramophone switch — Combined volume control and power supply switch—Latest type Radiotron valves—Straight line dial in four colours, size 12½in. by 7½in.—Jensen 12in. speaker — Custom built — Six months' guarantee. **PRICE** **£34/7/6**

HI-FI MODEL E22 FEATURES: Same as model E15 but incorporates treble and bass boost with independent controls—Special Jensen twin speakers comprising a 12in. "woofer" with 3in. diameter magnet unit and separate 6in "tweeter" speaker with crossover network — Reproduces perfect high treble notes and deep bass notes without "drumming" or distortion — Frequency coverage 40 to 13500 cycles. **PRICE** **£40/15/-**

MODEL F47: A custom-built 5-valve radiogram chassis with superb tonal quality and high undistorted output —Complete with Radiotron valves and Magnavox 12in. Speaker. **PRICE** **£22/15/-**
Packing included. Freight extra

All above chassis have been design tested and approved by the Valve Application Division of Amalgamated Wireless (Australasia) Ltd.

Cocktail and Standard

RADIOGRAM CABINETS

Many popular designs available including contemporary in natural maple.

NEW CABINET MODELS FOR HI-FI CHASSIS incorporate vented speaker enclosures which provide for dual speakers in separate compartments, with "woofer" compartment felt lined and draped. First-class finish.

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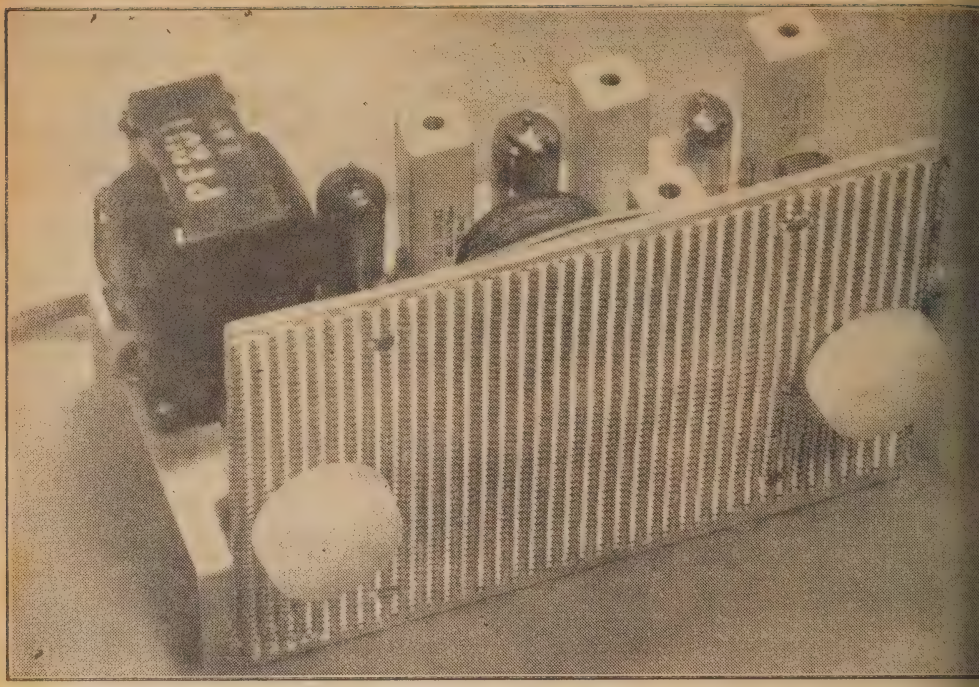


The set as it will appear when complete. An attractive cabinet is planned to go with it and the expanded aluminium speak grille will show through the front cut-out. Note the miniature valves and coils.

THE "LITTLE GENERAL" FOR 195

Here is a beginners' article with a difference. If you imagine that a conventional superhe is too hard for you to build then you're the fellow we want. We aim to prove you wrong— and we think you will enjoy the way we do it.

By PHILLIP WATSON

YES, this article is directed at the really raw beginner; the type of fellow who, while mad keen to get started in radio, still views a circuit digram with bewildered awe and a superhet as something quite beyond his ken.

While he may have tinkered with a crystal set or simple one-valve set he probably feels that this is as far as he dare venture without further help; and pretty extensive help at that.

Our mail tells us only too plainly that there are plenty of readers in this category — just itching to go, but scared of tackling something which they feel is beyond them. For their benefit we have adopted a somewhat unusual approach; an approach which we hope will prove that, if you know the hot end from the cold end of a soldering iron, you can make a set which will be every bit as good as an equivalent commercial type.

Looking at the matter objectively the beginner's diffidence is not really surprising. The simplest four valve set is still a meaningless jumble of wires to the uninitiated and leaves him completely bewildered. He hasn't a clue where to start and considerable doubt as to whether he would ever finish it if he did.

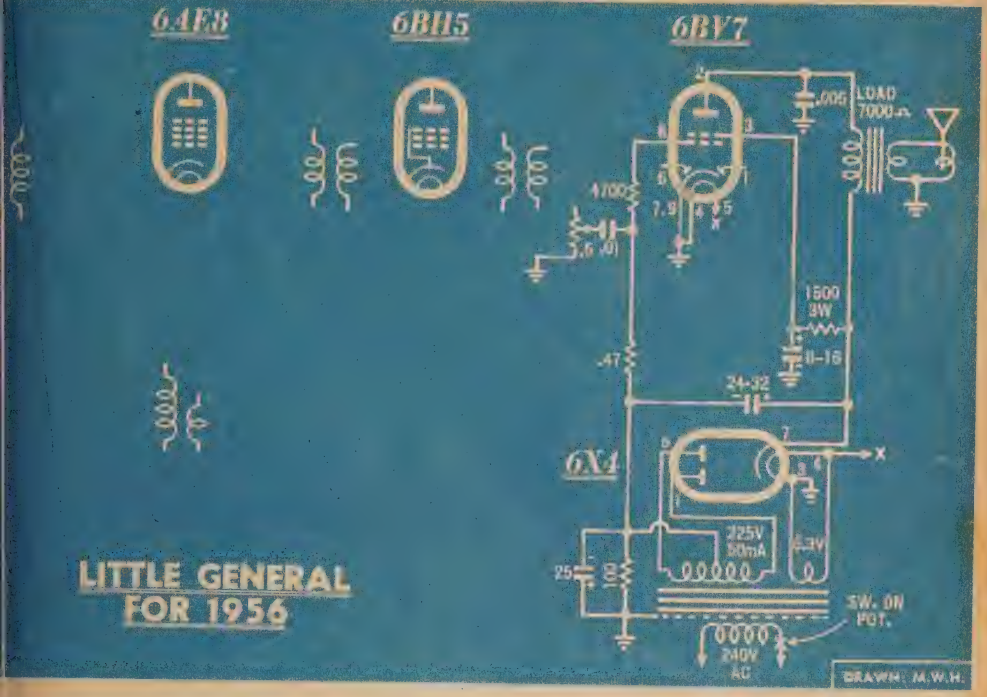
Again, the amount of time which the average enthusiast can spend on his hobby is often very limited. There are only a fixed number of free ho in a week and these must usu be divided between the minor hou hold repairs which are always w us, one's normal social activities, perhaps a rival hobby.

Add to this the fact that m have to wait until the evening n has been cleared from the kitc table before they have a place work—and pack everything a again at the end of the eveni work—and we find that the t number of hours really spent the project may be quite limite

We frankly confess that these problems which we may not l always fully appreciated, simply cause we can afford to devote

A MODERN MANTEL RECEIVER

FIRST SECTION—POWER SUPPLY & OUTPUT STAGE



if you have always shied clear of circuits until now we suggest you study this one. It is only a small portion of the set and quite easy to follow. Try to follow it in conjunction with the wiring diagram on page 67.

orking time to developing and ng a particular project. While s a good deal more to making ist one than there is to copy- this is largely offset by the er's inexperience, for it means is rate of progress will natur- a good deal slower than that killed worker.

APPROACH

bf which prompted the idea of ering a constructional article "instalment" plan; spreading say, three months rather than ing it all in one dose. The ve thought about the idea the we liked it. With the story over a longer period we could sly devote more space to each lar problem, thus dealing with n more completely.

ell as making possible a much and more detailed presen- the reader would also stand efit by reason of the smaller is made on his time — and ket — over a given period. her it seemed an ideal ar- ent..

inspired we set to work. We right at the outset that the set should be a "real" set y sense; a modern design, us- latest type valves, miniature coils, speaker, &c., and capable, when finished, of taking its place as a useful addition to the household.

We have planned a cabinet for it and this, too, will be described in detail so that you can make your own. The finished set will be one for which you won't need to make any apologies; on the contrary we think you will show it off with pride.

BUILT AND TESTED

To make sure that the design we finally chose would be a completely practical one we first built and tested the entire set — you can see it pictured at the head of this article—then stripped it back to the portion we are describing this month. As the series proceeds we will rebuild each section until it is once more complete.

So there it is: tag along with us for the next three or four months and we will show you how to build an attractive mantel receiver, one which will give you hours of listening pleasure and of which you can be justly proud. We will take you step by step, wire by wire, in a manner which the merest beginner should be able to follow with ease. And we will go at a pace which you can afford—both in time and money.

Interested? Right, let's go.

First, a few details about the portion we are to build this month. It consists of what we call the power supply and the output stage. This includes the speaker and we have arranged matters in such a way that, when finished, the unit may be plugged into the power and a few simple tests conducted to show that all is well thus far. You can even use it as a simple record player.

A detailed parts list is printed in an accompanying panel but we will enumerate the major components here and tell you something about them. In some cases we will mention certain brands and we had better clarify this point before we go any further.

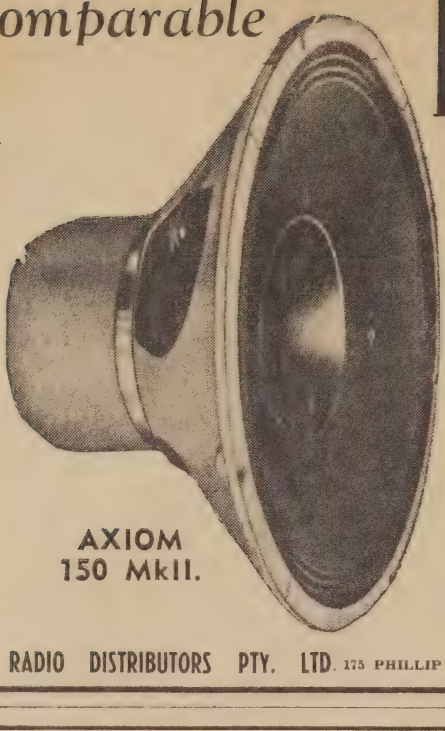
MATTER OF POLICY

For obvious reasons this is a practice which we normally avoid, leaving it to the reader to select the particular brand he prefers. However, we consider this case is somewhat different. The purely physical characteristics of some components are just as important as the electrical ones and the beginner cannot be expected to know which is suitable for a particular chassis layout and which is not.

This leaves us no alternative but to advise him of a suitable brand,

UILD IT IN EASY STAGES

incomparable



AXIOM
150 MkII.

HIGH FIDELIT

Facts and figures are always available Goodmans Loudspeakers. But when yo back for an evening of musical enjoyment probably won't be thinking of flux densit impedance. The final test is your critical And the more critical you are the better like it. Read the specifications, and your will tell you GOODMANS Loudspeakers better. Listen — and your ear will prov

AXIOM 150 MkII
BRIEF SPECIFICATION:

Frequency coverage	30/15,000
Fundamental Resonance	35
Flux Density	14,000
Max. Power Handling capacity	15 watts Pe
Nett weight	12lb

Fully dustproof

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Write for full details of the Axiom 150 MKII and other High Fidelity Loudspeakers

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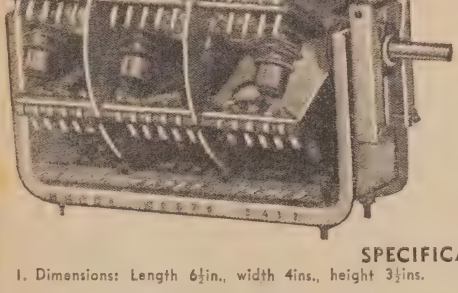
RECEIVER COIL TURRETS FOR HAMS



Gorler Model F320

Specialised communications components amateur receivers or low powered tra mitters.

PRICES

Model F320 coil turret, complete with wound c slugs and trimmers, 500 Kc/s to 30 Mc/s. **£20 (lis**

Model F320 coil turret as above but less coils trimmers. **£10 (lis**

SPECIFICATIONS

1. Dimensions: Length 6¼in., width 4ins., height 3⅝ins.
2. Frequency range: (6 bands) 500 Kc/s to 30 Mc/s.
3. I.F. channel. 455 Kc/s.
4. Coils complete with trimmers and slugs.
5. Stages available: R. F., Mixer, Oscillator.
6. Turret contacts—5 per coil—Rhodium plated.
7. Tuning condenser required—3 gang, 200 pF maximu per section.
8. All circuits are Hi-Q with only best quality ceram trimmer condensers and polystryne coil formers.
9. Turrets also will be available less coils and trimmers f low powered transmitters or VHF convertors.
10. Any coil bank may be extracted for modifications witho interruption to operation of other banks.

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this does not infer that other
ds are in any way inferior. It
ly means that they may be
anically unsuitable for this
cular project.
major item is the power trans-
er. The one we used is a Fer-
type PF201 and is a perfectly
ard design readily available
most dealers. Other manufac-
s make an electrically identical
and any of these could be used
ded they will suit the chassis
n.

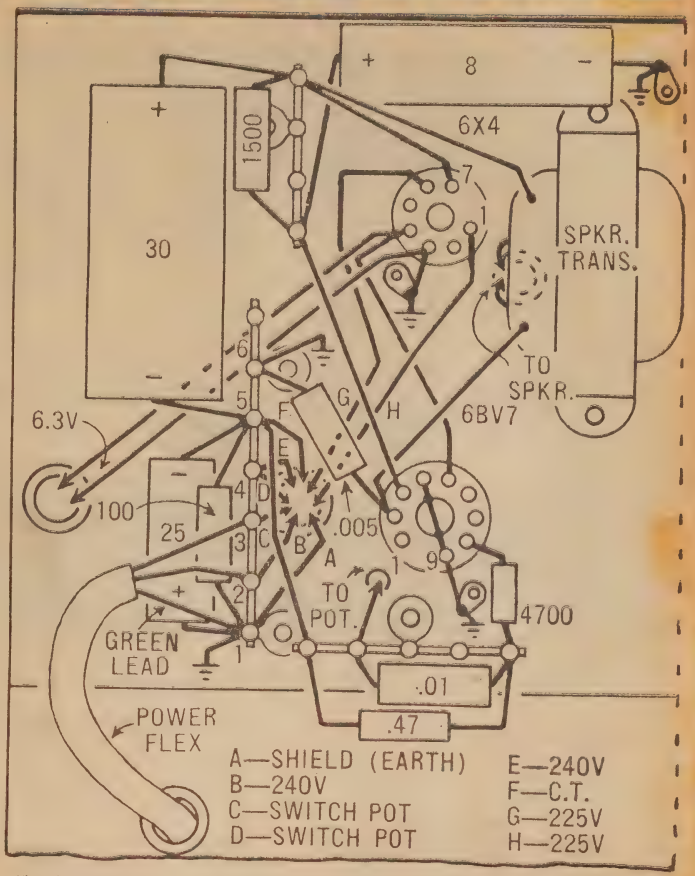
WINDINGS

has three windings, a primary
connects to the mains, a HT
dary which is centre tapped
which delivers 225 volts each
f the centre tap, and a filament
ring 6.3 volts. Have a look at
ircuit and you will see it por-
d in the lower section with
three windings clearly marked.
t the speaker. The new Rola
5C fitted in with our proposed
et design very nicely and, as
case with most oval speakers,
s possible good performance in
ll space. With the speaker we
consider the speaker trans-
r, and this is a type EBG96
by the same organisation. It
signed to present the correct
7000 ohms) to the 6BV7 valve
used with the 5C speaker.
volume control is a standard
available in a number of
s and any of these should be
suitable. A useful feature is
uilt-in on-off switch which
i to control the 240 AC volts to
t. This may be regarded as an
al feature but most fellows
robably want to retain it.

RNATIVE TYPE

have specified it as a single
switch but you may have to
for a double pole type. In
ase there will be four lugs
ou will have to determine
two are a "pair". A simple
uity tester, such as a torch
and battery, will serve and
pair may be used. The un-
pair is simply ignored.
valves are required at this
a 6X4 rectifier and a 6BV7
ed detector and output valve.
X4 performs the function of
ting the 225 volts AC from
f winding of the transformer
milar voltage in DC. It has

ALL DETAILS OF THE WIRING



This diagram shows the position of each wire under the chassis. Note also the orientation of the valve sockets and the general layout of the major components. Compare it with the photograph on page 69.

a seven-pin base and requires a miniature seven-pin socket.

The 6BV7 is quite a versatile valve. Its main function — and the one for which we will be using it at the moment — is that of an output valve, or one which delivers audio power to the speaker in sufficient quantity to make it readily audible.

In addition it has two diode plates. One of these is used to detect the incoming signal (i.e., extract the audio from the modulated signal) and the other to provide an automatic volume control (AVC) signal for the two earlier stages. These two latter functions will not worry us at the moment. The socket required is a miniature nine pin.

WAFER SOCKETS

Valve sockets are available in a number of designs but we have deliberately chosen wafer types for this set. In one position at least (the 6BH5) this type has certain electrical advantages and we have used it in the other positions for the sake of uniformity. Other types may locate their pins differently relative to the mounting holes and should not be used unless this point is checked.

A very useful component in all

PARTS LIST

ece aluminium for chassis 7¾in X 9in
16g.
ece aluminium for V/C bracket 2⅞in
1¼in X 16 or 18g.
wer transformer 225V 50 mA 6.3V 2A
/pe PF201.
val loudspeaker type 5C.
eaker transformer type EBG96.
X 4 valve.
V7 valve.
in miniature wafer socket.
pin miniature wafer socket.

CAPACITORS

mfd 350 PV electrolytic.
mfd 40 PV electrolytic.
mfd 350 PV electrolytic.
mfd 600V paper.
.15 mfd 600V paper.

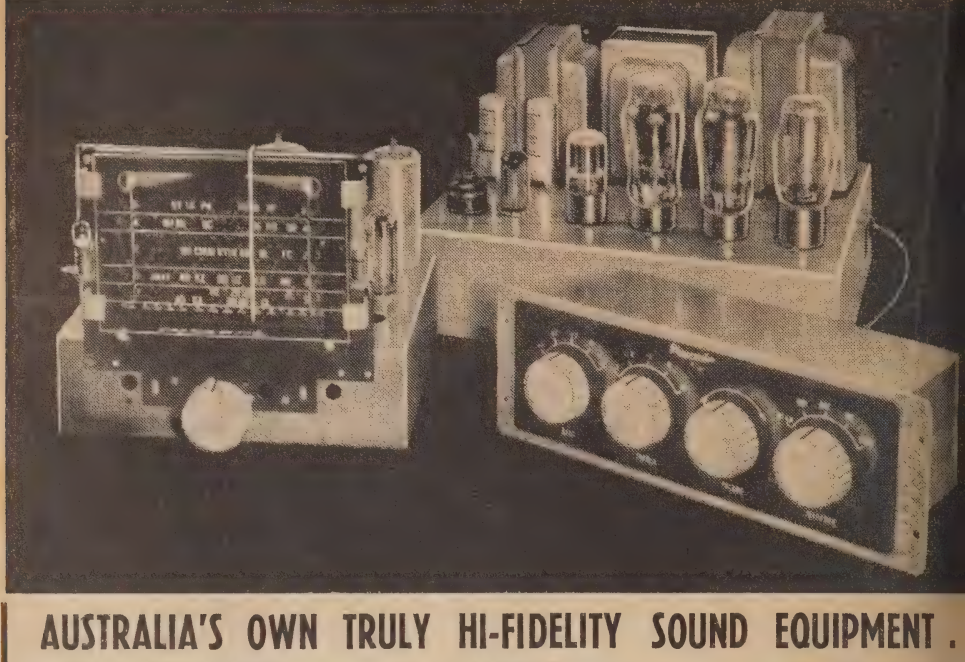
RESISTORS

1 .5 meg. pot. with single pole switch.
1 .47 meg. ½W
1 4700 ohm ½W
1 1500 ohm 3W.
1 100 ohm ½W.

MISCELLANEOUS

1 8 tag terminal strip.
2 5 tag terminal strips.
3 grommets ⅜in.
1 grommet ¼in.
1 knob type MV9.
20g tinned copper wire.
3 core power flex.
Hookup wire.
3 pin plug.
Nuts and bolts.

PLAYMASTER



AUSTRALIA'S OWN TRULY HI-FIDELITY SOUND EQUIPMENT.

● AMPLIFIERS ● CONTROL UNITS ● TUNERS

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BROADWAY
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Dear Sirs,

Please mail me your free catalogue descril Playmaster, Hi-Fi equipment.

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wiring is the terminal strip. are available in a number of and are used mainly to pro- anchor points where compon- pigtails have to be joined to or other pigtails, or to sup- individual components. Note ne, and sometimes two, of the nals are automatically earthed e chassis when the strip is ed.

remaining minor components t particularly critical, provid- y are miniature (now virtually rd) types rather than the older larger types.

t we must consider the chassis. ve prepared a drawing show- the dimensions, size and posi- holes, &c., in such a way that should be no difficulty in ating our original model. You ake your own from aluminium may have your dealer order y-made steel one from any of gular chassis manufacturers.

fellows will probably want e their own and we have de- ely simplified the design to nd. 16 gauge aluminium is eing heavy enough to make chassis without the need for yet still light enough to be worked with simple tools.

TRUCTION

will need a piece 7¾in x 9in iece from which this size can You will also need a scrap which the volume control t can be made. If you can pur- the right size piece for the it will save some cutting and nd make things a good deal Scribe a line parallel with in side and 1 5/8in from the n each case. These are the s to be bent over to form the nd back of the chassis.

bending is most easily per- using a good vice and a few of wood. Clamp the alumin- tween two pieces of wood and the whole assembly in the king care that the line of the d bend is placed accurately he edge of the wood. Then, nother piece of wood, exert e on the free portion of the um and bend it over at right

ttle truing up may be neces- ter the major bend is com- and then the other side may t in a similar manner. The should be a perfectly rigid which will sit true on the of the cabinet.

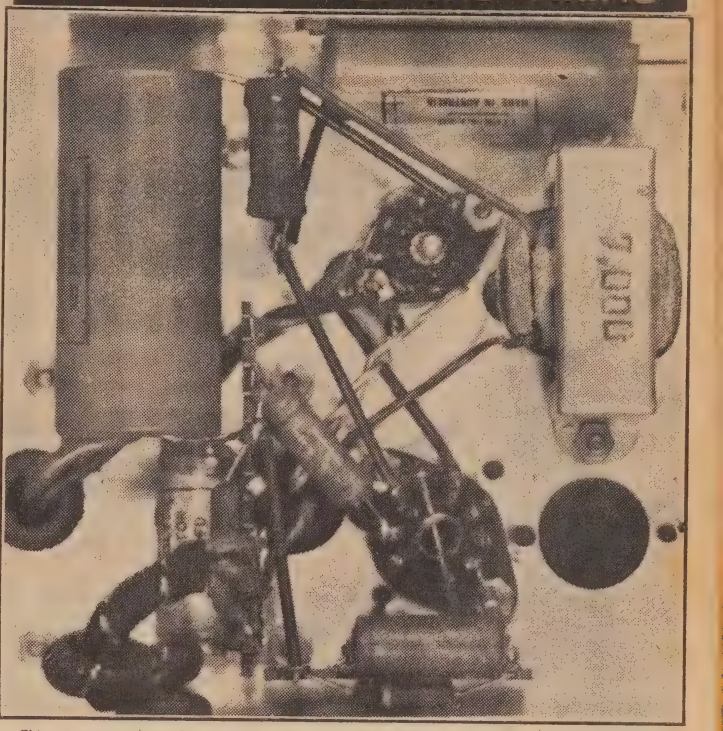
NG THE HOLES

the various holes must be or punched. The smaller ones present any problem and may e with any simple hand drill. ger ones are not quite so and you will have to decide to drill and file them by r whether to invest in a of socket punches.

atter are very good but rep- a considerable outlay which be justified unless you pro- do a fair amount of work. other hand you can get by little extra effort using no an a conventional drill and nd file.

mark out the circle you pro- cut and then drill a series , say 1/8in, just inside the nd as close together as pos-

CLOSE-UP VIEW OF THE WIRING



This picture is virtually full size and gives an excellent idea of how your set should appear when the first portion is completed. Note the terminal strips on which the minor components are mounted.

sible. Break away the small amount of metal between the holes and clean up the edges with the half round file. With care a very neat hole can be produced.

Another alternative is to purchase a cheap carpenter's centre-bit of the required size, drill a centre hole to take the lead screw, then use the sharp cutting blade to cut out the circle. A little machine oil to lubricate the cut will help and, with patience, a perfect hole may be cut. The main thing is to use a minimum of pressure and to turn fairly fast. An ordinary carpenter's brace is used to hold the bit.

However, whichever way you go about it, it is a good idea to do as much mechanical work as possible on the chassis at this stage. While it is not impossible to cut large holes after the set is partly assembled, it is a good deal more difficult and there is the ever present possibility of damaging an expensive component.

On the other hand, some of the smaller holes will be easier to locate accurately when the components with which they are to be associated are on hand. This applies particularly to the gang mounting brackets, valve sockets and coils. Similarly the holes in the volume control bracket and chassis and the speaker baffle and chassis should match in each case.

Another aspect of the coils is that the chassis has been designed on the basis of a particular range (Aegis miniature) and the holes will not suit other miniature types. If another brand is contemplated for any reason it will be necessary to modify these holes accordingly. They are marked "A" "B" "C" and "D" on the chassis drawing.

VOLTAGE TABLE

All readings referred to chassis		
Cathode	(7) 6X4	225 volts
Screen	(3) 6BV7	215 volts
Plate	(2) 6BV7	200 volts
Back bias resistor. (Negative end mfd electrolytic)	25	3.8 volts

ASSEMBLY

With all the holes cut we can pass on to the next stage—assembly.

Reference to the wiring diagram will show where all the major components are mounted and the job is mainly a matter of bolting them in position on the chassis. Brass bolts —normally 1/8in x 3/8in round head —with suitable nuts are normally used and solder lugs will need to be placed under some as indicated by the wiring diagram.

(We will not mount the speaker at this stage; it will be a good deal safer in its box until some of the preliminary mechanical work is done. We will describe the method of mounting a little later.)

The main point to watch is that the parts are correctly orientated as in the diagram, thus retaining the

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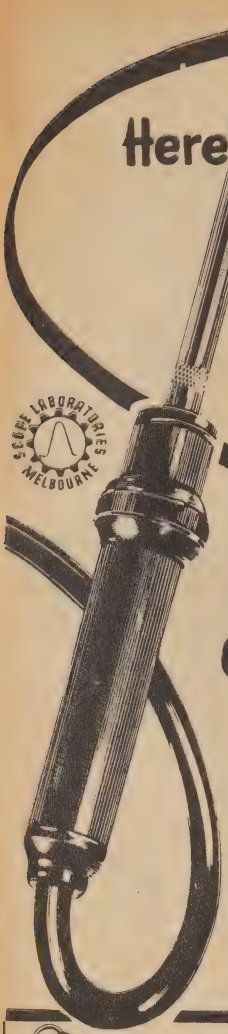
for all mechanical, radio and electrical service, instrument and light sheet metal work.



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Operates from transformer or battery.

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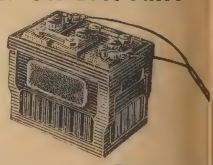
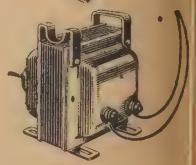
A maintenance service is available at all times. Scope is fully guaranteed.

OPERATES FROM TRANSFORMER OR BATTERY



Because Scope operates on 2.5/6.3 volts, it is a simple matter to connect it to A.C. mains through a National transformer (optionally supplied) to suit 240V, 50V, or 32V supplies, or to any 4V tap on a 6V or 12V car battery.



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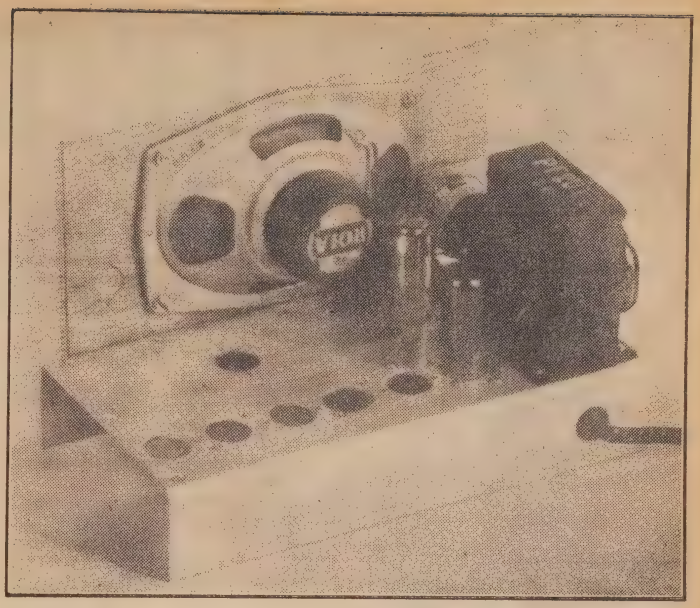
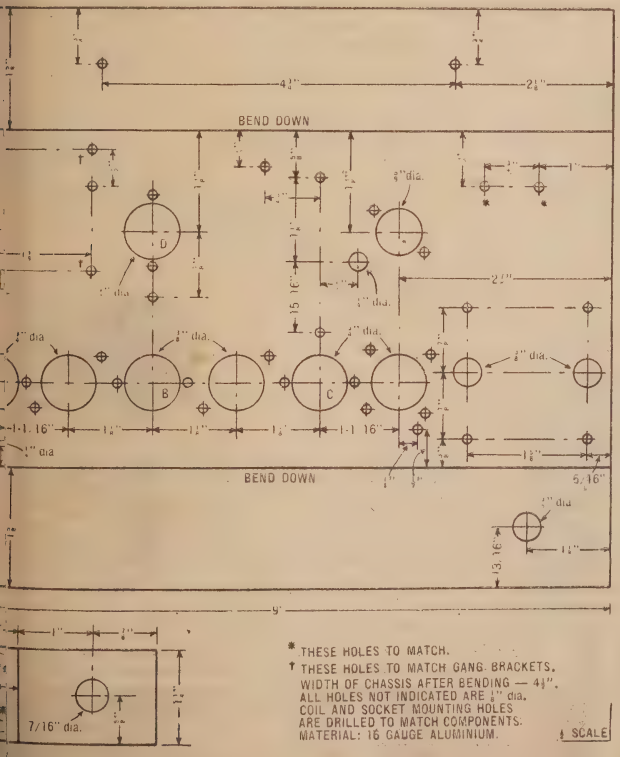
leads achieved in the original
n.
ore the power transformer is
ted the two lead holes each
f it should be fitted with grom-
to protect the wires from pos-
damage against the sharp metal
of the hole. A grommet is
used to take the power cord
gh the back of the chassis. Note
not in the cable to avoid strain
e soldered terminals.
) of the three tag strips are
ted by bolts securing other
onents and this point should
atched. The largest tag strip
eight-terminal type from which
erminal must be clipped to
it correspond with that shown
diagram. Similarly, the four-
al type is a five-terminal type
which a terminal has been cut.
h all the major parts mounted
ome to the third, and final,
of this portion — the wiring.
of the wiring can be done with
ads and pigtails which are part
components, other sections will
are tinned copper wire, and
again plastic covered hook-
e.

SFORMER FIRST

mence by identifying the
transformer leads. These
e color coded and the trans-
should be accompanied by a
e code sheet.
that there are two black
one the HT centre tap and
her a primary lead, and it is
le to get these mixed un-



A rear view of the chassis showing the larger components. The 6BV7 is nearest the camera, the 6X4 behind it, and the combined volume control and power switch behind the transformer. The empty holes will take the valves and coils of the remaining section.



* THESE HOLES TO MATCH.
† THESE HOLES TO MATCH GANG BRACKETS.
WIDTH OF CHASSIS AFTER BENDING — 4½".
ALL HOLES NOT INDICATED ARE ¼" dia.
COIL AND SOCKET MOUNTING HOLES
ARE DRILLED TO MATCH COMPONENTS.
MATERIAL: 16 GAUGE ALUMINIUM.

SCALE

are all details to enable you to make your own chassis. A set of socket
es are handy if you can borrow them, but they are not essential. Details are
also given of the small bracket to hold the volume control.

less one is forewarned. The manner in which they are grouped as they leave the winding leaves little doubt, but a further check may be made if an ohm meter or simple continuity tester is available.

Bring these leads down through the grommeted hole and distribute them to the various points as indicated by the wiring and circuit diagrams. They should be long enough to reach directly in each case. In addition a pair of leads, made from plastic hook-up wire, are run from the switch contacts on the volume control, through the same grommet hole, and to the appropriate terminals on the tag strip.

First connect the two primary wires to terminals 2 and 4 of the tag strip, one of the leads from the pot. switch also connecting to terminal No. 4. The other switch lead goes to terminal No. 3. The shield lead (usually a light lead with cotton covering) is taken to terminal No. 1 (earth).

The power cord should be a three core variety, the green (earth) lead going to terminal No. 1 and the other two wires to terminals No. 2 and 3 respectively. This completes the primary circuit.

Take the three secondary leads next. The centre tap connects to terminal No. 5, while the remaining two go to pins 1 and 6 of the 6X4 socket. These latter are best twisted together up as far as the socket.

The heavy filament leads are taken through the other grommet and to pins three and four of the 6X4 socket. Pin three is earthed to the chassis by a short length of tinned copper wire and a solder lug under the mounting bolt.

A short length of tinned copper wire is also required for the 6BV7 socket This connects pin four, the

(Continued on Page 79)

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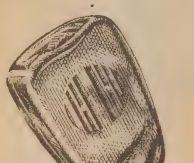

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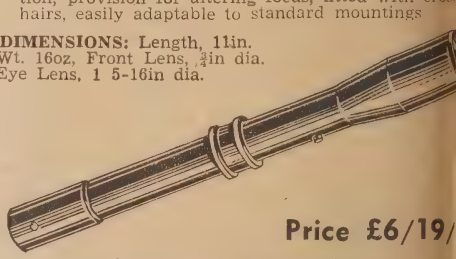

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6U7G	7/11 "
6AC7	3/11 "
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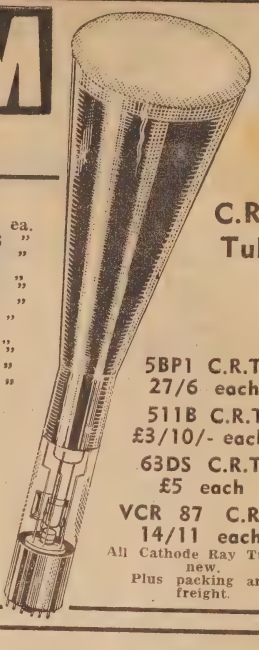

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511B C.R.T. £3/10/- each

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19% Screen Taps.

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Resp.: As 931-15.
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Sec.: 2 or 8 ohms.
Resp.: As 921-15.
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HIGH FIDELITY

+—1 db 30-15,000 c

OUTPUT TYPE

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TYPE 897 — 15 wa
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"HIGH FIDELITY" CLICKS, PLOPS

BY THE TECHNICAL EDITOR

he enormous popularity of wide-range equipment, both commercial and home constructed, as had one rather interesting by-product—a variety of complaints about the virile noises it can make when electrically "provoked".

ADERS tell us that they have ought or built some wide-range which performs very well but h, from time to time, emits loud s variously described as ks". "plops", "bangs", "crashes"

ey want to know what they can out it, because their composure, several minutes of delightful ing, can be rudely shattered by ty "plop" as the refrigerator in or as somebody operates a h elsewhere in the house.

The fact that such noises are en distressing stems from the y nature of the equipment. bility to reproduce trans- ts, good bass response and stantial power output com- e to ensure that any electrical pulses which enter the signal cuits are reproduced to the t advantage!

re is little frequency or power tion to curb their severity, as ss pretentious equipment.

ording to circumstances, le with "plops" or other such s may occur:

On radio only.

Whenever the amplifier is in – for radio or records.

Only when amplifier control nes are operated.

first case is one of ordinary interference, which calls for known methods to combat it receiving equipment should be d, either via the power point a separate water-pipe earth, electrical wiring is old or in ay suspect.

D AERIAL

aerial should be extended, pre- y out-of-doors and away from ical wiring. Where trouble is ted from tramway or street , it is often helpful to erect plete noise-reducing aerial sys- of a type which is available ercially.

nother cases, a line filter may connected between the equip- and the power point.

re the source of the "plops" ntified — automatic irons and rators are frequent offenders ter in the appliance lead may re effective than in the lead e radio equipment, because on via the power wiring is ey minimised.

n ll this, the purpose is:
1 To reduce the interference at rce, as far as possible and
2 To get as much signal to the as possible, so as to swamp -generated interference.

In remote areas, the signal from local stations may not be sufficient to swamp out electrical noise or, yet again, interference from distant transmitters on adjacent channels.

For these reasons we have always been cautious about recommending wide-band tuners for use in other than good receiving locations.

BETTER PROPOSITION

For the same reason, also, our "Wide-Band Tuner Number 2" is a better overall proposition than the original Wide-Band Tuner. The two give identical results as wide band tuners, but the later job, using a switched 455Kc IF channel, can be set for increased selectivity on occasions when adjacent stations or electrical interference make wide-band listening impractical.

So much for the "radio" aspect of the problem.

Switching transients are often distressingly apparent in wide-range amplifiers, even when they are being used purely for record reproduction.

This stems from their high overall gain, in many cases, and from the fact that certain sections of the circuit may be responsive to frequencies as high as half a megacycle.

The trouble may be aggravated, if there is any tendency to instability in the amplifier, particularly at the very low frequencies. Such tendency emphasises and prolongs any sharp pulses which may reach it.

Anything which can be done completely to stabilise an amplifier may therefore help matters, though it is not likely to effect more than a second-order improvement. The basic trouble still requires treatment.

As a rule, switching transients arise only from electrical circuits in the same house as the equipment, notable sources being the refrigerator cut-out, automatic flat iron and individual light or power switches.

The effect is usually quite a random one, which does not seem to relate to the exact type of equipment or to the switches or appliances involved. It just happens, in some houses, probably as the result of some stray inductive or capacitive property in the electrical wiring and-or the appliances connected thereto.

Because it is a stray effect, there is no certain cure for it.

The amplifying equipment should be earthed, as a starting point, but note taken as to whether the best effect (if any) is obtained from an earth back to the power wiring or from a separate pipe driven into moist ground nearby.

As a general rule, it is unwise to operate the amplifier from the same power socket as the appliance causing the trouble. Quite frequently, a marked reduction in switching transients can be effected by operating the amplifier from another, more remote socket, even though it involves a larger run of power flex.

Another worthwhile trick is to try changing over the active leads in the appliance plug taking care, of course, not to disturb the earth wiring. Such a change may transfer

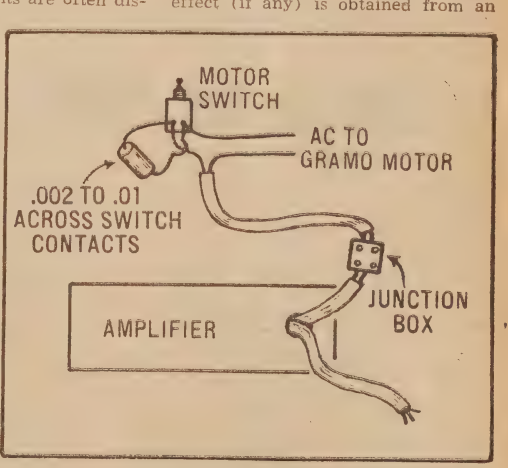

Figure 1: A small tubular capacitor wired across the switch contacts cured a loud "plop" which the switch caused in a particular installation. Tests showed that no "damping" resistor was necessary, the arcing at the switch contacts being less than with the capacitor in circuit.

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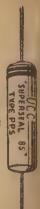

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rmostat switch from the active neutral lead, or vice versa, duce the amount of transient o the power wiring.

effect of changing over the er's power connections can tried.

extreme cases, it may be hile to have the house elec- wiring checked over, par- with a view to establishing ntinuity of all earth wiring duit circuits.

AND ERROR

old, such observations make vague reading but the truth there is no sure-fire method nating trouble from switch- nsients. It is just a matter g the various measures until tive cure is found.

e writer's case, no special ons happened to be neces- rmal household circuits in- g, at the worst, no more than click in the speaker.

main problem which the ad to face in this connection really terrific "plop" each e gramo motor switch was . It was really frightening ntensity, at least to other s of the household.

filter was tried, first in the ead, then in the amplifier without success. The motor as left floating, then various- ed direct, to the amplifier, he pickup braid. Nothing y significant difference.

ure which finally worked ery simple one — to con- 005 600V tubular capacitor across the switch contacts. mum value may vary some- h different motors but any- om about .002 to .01mfd o the trick in most cases.

as the writer's equipment rned, the noise now made otor switch varies from nil d click, depending on just t of the AC cycle the con- pens to operate.

tally, a 100-watt lamp is onnected in series with one e motor to reduce the oper- tage and the torque to the imum needed for satisfac- ration.

ROM SWITCHES

ird noise problem, as men- rlier, has to do with clicks by selector switches, when Function, Treble or Bass Slight clicks are no special particularly as the switches m manipulated during any record or program.

riter has experienced the n only one particular con- but the story is worth re- case a few readers have been "caught".

inally constructed, the con- gave no special trouble ching clicks, although they htly more obvious than in ilar units which had been

period of use, however, egan to produce quite loud n the speaker, when almost n—Function, Treble or Bass ved to almost any position. e so bad at last that an ion was called for.

the whole circumstance tle in with complaints we had received from a few readers about "excessive switching noises"—apparently a lot louder than any we had ever previously observed.

It didn't take long with a multimeter to discover that a positive voltage was appearing on supposedly "earthy" portions of the circuit with the switches in certain positions.

Tracing back revealed a much larger voltage on the "grid" side of the interstage coupling capacitors—enough to produce a quite definite reading on the 250-volt range of a normal multimeter.

FAULTY CAPACITORS

In other words, the coupling capacitors appeared to be leaky, in the electrical sense of the term.

This was unexpected, because they were allegedly high-quality imported types, which had been selected especially for the control unit because of their small physical size.

Unfortunately, they had been tucked down against the socket and behind the tagstrip, so that they were both in a very inaccessible position.

In due course, however, they were removed and tested for leakage on the RT&H VT voltmeter. In both cases, they gave a leakage reading of about four megohms!

Assuming a voltage of about 100 on the preceding plates, this would mean that several volts could appear on the following grid, depending on the settings of the switches and volume control.

No wonder the control unit had produced "plops" when the switches were rotated.

We traced the capacitors back to their source and found that they came from an allegedly faulty batch, which had found its way into the local radio shops.

If your control unit causes loud "plops", therefore, instead of a small click when the switches are manipulated, you can suspect the coupling capacitors forthwith.

In the unit under discussion, replacement of the faulty capacitors with good ones eliminated the plops completely.

But what of the small "clicks" which remain? Can they, too, be eliminated?

In point of fact, it is rather doubtful whether they can, because of the high gain of a modern amplifier system and the small potentials which appear to collect on sections of the circuit which are supposed to be "earthy".

One worthwhile addition can be made, however, to all R,T&H Control Units which use Function and Tone switches. It will minimise clicks which may occur with one or two particular switch combinations.

Figure 2 extracts the relevant switching details from Control Unit Four, which will serve as an illustration.

With the switch sections S1a, S1b and S1c in the "Radio" position as illustrated (S1d is not shown), there

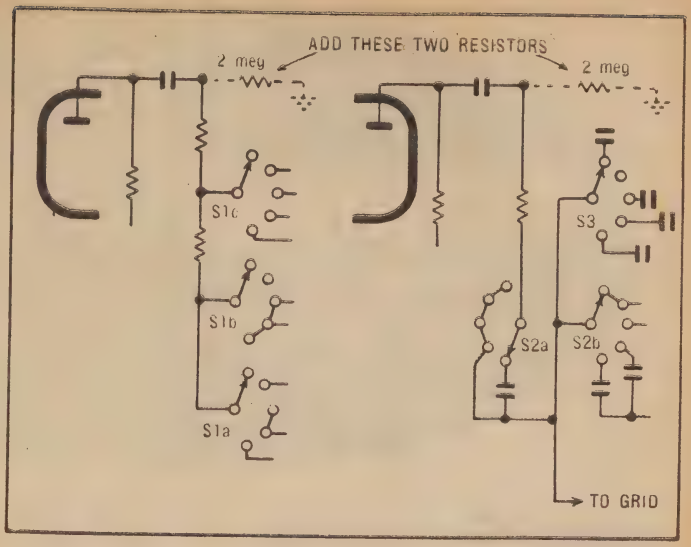

Figure 2: A couple of 2 megohm resistors, wired as shown will prevent stray potentials from building up on the coupling capacitors in R,T&H Control Units, with the switches in certain critical positions. Switch clicks are thereby reduced.

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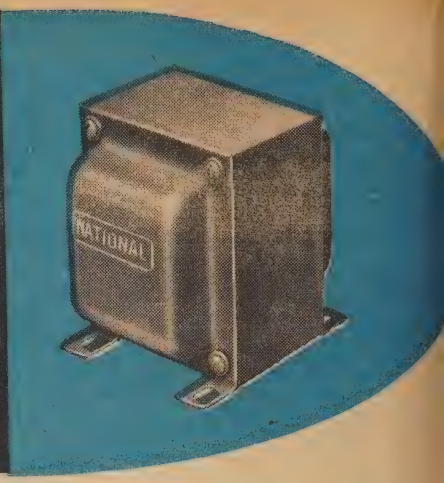

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TYPE	PRIM-ARY	mA	H.T. VOLTS	FILAMENT RATINGS	MOUNTING
U or F30/150	230/240	30	150/150	6.3v/1.7a	Midget U or F
U or F40/150	"	40	150/150	6.3v/2a	Upright or Flat
U or F40/285	"	40	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F40/325	"	40	325/325	" "	Upright or Flat
U or F50/225	"	50	225/225	6.3v/2a	Upright or Flat
U or F60/285	"	60	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F60/325	"	60	325/325	" "	Upright or Flat
U or F60/385	"	60	385/385	" "	Upright or Flat
U or F80/285	"	80	285/285	6.3v/2a 6.3v/2a 5v/2a	Upright or Flat
U or F80/325	"	80	325/325	" " "	Upright or Flat
U or F80/385	"	80	385/385	" " "	Upright or Flat
U or F100/285	"	100	285/285	6.3vct/2a 6.3v/2a 5v/2a	Upright or Flat
U or F100/325	"	100	325/325	" " "	Upright or Flat
U or F100/385	"	100	385/385	6.3vct/2.5a 6.3v/2a 5v/2a	Upright or Flat
U or F125/285	"	125	285/285	6.3vtc/2a 6.v/2a 5v/3a	Upright or Flat
U or F125/325	"	125	325/325	" " "	Upright or Flat
U or F125/385	"	125	385/385	6.3vct/2a 6.3v/5a 5v/3a	Upright or Flat
U or F150/285	"	150	285/285	" " "	Upright or Flat
U or F150/325	"	150	325/325	" " "	Upright or Flat
U or F150/385	"	150	385/385	" " "	Upright or Flat
U175/425	"	175	425/425	6.3vct/3a 6.3/2a 5/3a	Upright
U200/385	"	200	385/385	6.3vct/3a 6.3/3a 5/3a	Upright
U250/385	"	250	385/385	6.3vct/4a 6.3/3a 5/3a	Upright
*T80/265	"	80	265/265	6.3vct/2a 5v/2a	Upright

*Low Field Tape Recorder Transformers. Other types available on request.

TYPE	INDUCTANCE in HENRIES	mA	RESISTAN D.C.
B.14/60	14	60	520
C.20/60	20	60	500
D.30/60	30	60	600
C.15/80	15	80	430
E.20/80	20	80	300
E.30/80	30	80	380
F.15/100	15	100	300
F.15/125	15	125	250
F.15/150	15	150	200
F.12/175	12	175	160
F.12/200	12	200	125
F.12/250	12	250	133

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earth return for the low potenside of the coupling capacitor. efore, even a slight leakage gh this capacitor will allow the otential side to acquire a posipotential with respect to earth. erefore, switching from "Radio" Pickup" may produce a dise click, though the reverse pro- e would not. To prevent it ening in this case, it would be necessary to wire the blank on on S1a, S1b or S1c to earth.

the second section of the cirthere is normally an earth n for the coupling capacitor gh the output lead and the esistor of the following valve ually the first valve in the main fier.

vever, a careful check of the t will reveal that the DC return is broken with S2 in the pass sition, as shown. Thus, switchom bass cut to normal after iod of operation may produce k, though it will not happen when switching from normal to bass cut.

Shunting the bass cut capacitor at S2 with a resistor would obviate the difficulty but the resistor would need to be high in value to prevent the bass cut function from being compromised.

Other control units differ in detail from the one illustrated but similar effects can be traced to certain critical switch positions in most of the other units. These can be examined individually, if you want an exercise in circuit reading but, fortunately, there is one very easy way out of all such difficulties.

It simply involves buying two 2-meg. resistors and wiring them permanently into circuit between the low potential ends of the coupling capacitors and earth. The resistors will not have any noticeable effect on circuit performance, but they will keep the entire control circuit at earth potential, irrespective of the switch settings.

LITTLE GENERAL FOR 1956

(Continued from Page 71)

shield, and pin nine all to th lug under a socket mountolt. All the remaining wiring e with hook-up wire.

leads from the speaker transmay be a little puzzling if e not familiar with them. One will be of plastic hook-up and are the primary leads go to the power supply and late. The other pair will be of copper wire covered with ing tubing as will the ary. These connect to the voice coil. For the time these latter will simply pass the small hole in the chassis ve are ready to mount the

nnecting the electrolytics take at correct polarity is observed, end being positive. The only olarity to observe concerns er capacitors which have a inted at one end of the label. the end of the capacitor which be earthed in those applicahere one end is to be earthed. olume control has three con- (not counting the switch at the back) and the centre he moving arm, indicated by w on the circuit diagram. at the front of the control , clockwise from the centre to be earthed, to the metal of the control will do, and d lug is left vacant for the

the wiring is completed go erything very carefully and e connections against either ng or circuit diagram — or, ly, both. Make sure that e no blobs of solder lurking socket pins or other places hey can cause trouble. ut for insulation which may en damaged by the solderand which could possibly short circuit.

appears well you can make nents for a preliminary test. couple of lengths of hookconnect the speaker temto the transformer voice s. The speaker need not be at this stage.

Now fit a three pin plug to the power cable, connecting the green wire to the earth pin (better double check on this green lead at both ends). The disposition of the other two wires is not then critical.

Now, without any valves in place, plug into the power and switch on. If there are no obvious distress signs anywhere (it is unlikely that there will be) switch off and plug in the 6BV7. Switch on again and it should be possible to observe the filament heating up after a few seconds.

Finally, plug in the 6X4 and check again. Watch it carefully as it warms up and be ready to switch off at the first sign of trouble. This could be in the form of sparks or blue lights inside the envelope and would probably indicate a short circuit in the HT system.

If all is well the speaker should now show some signs of life, mainly in the form of a low hum when held a few inches from the ear. Now turn the volume control right up (maximum clockwise) and, without touching any other part of the chassis, place your finger on the unused terminal of the volume control. The result should be a healthy blurt from the speaker and will indicate that it is capable of handling signals.

(Incidentally, there is no danger in the above test but it is essential to keep your hands clear of the chassis in order to produce the desired effect.)

At this stage you can, if you are lucky enough to have one available, connect a crystal pickup between the vacant volume control lug and chassis and use the set-up as a simple record player. The gain will not be high and the performance of the speaker limited by the absence of a baffle, but it will work well enough to show that all is well as far as you have gone.

If the unit passes all tests with flying colors you may consider you have done a good job and be content to rest on your laurels until next month. Then we will tell you how to mount the speaker and wire another section.

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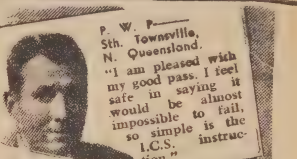
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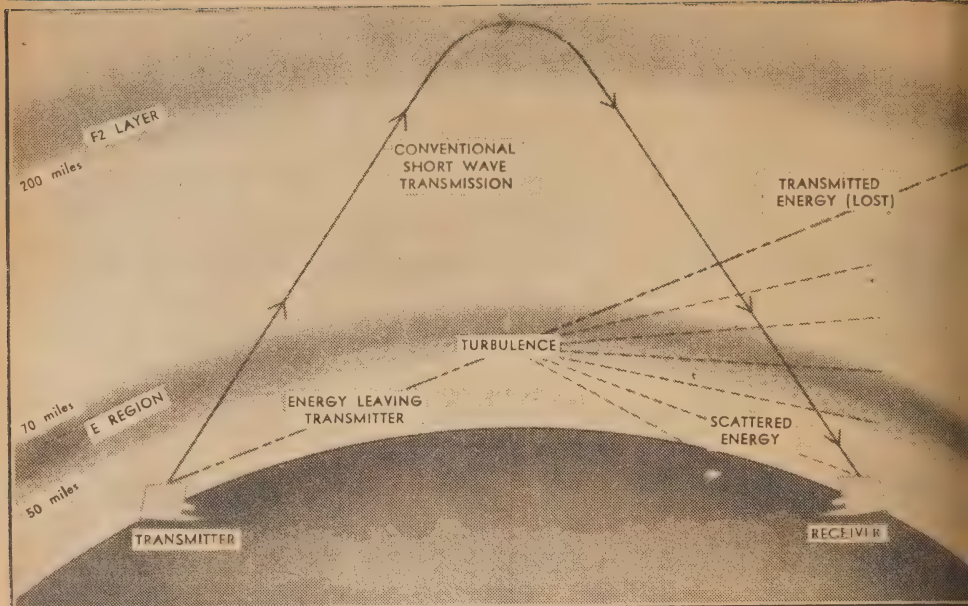


In conventional short-wave transmission, radio waves are transmitted beyond the horizon by reflection from the outer layers of ionosphere, usually in the F region as depicted. In ionspheric scatter propagation, energy scattered by turbulence in lower part (E region) of the atmosphere provides the received signal.

FORWARD SCATTER PROPAGATIO

Much has been heard, in recent months, about Forward Scatter, a means of propagatio which allows reliable communication to be achieved at VHF and UHF over distances far b yond the normal radio horizon. The following is an abridged version of a report on long investigations which have been conducted by the US National Bureau of Standards.

FORWARD SCATTER—a recently discovered mode of radio propagation—promises to extend greatly the limits of long-distance communication.

Through application of scatter propagation, new frequency channels can be opened up to long-range use, new path lengths can be utilised, and reliable service can be provided far beyond the line-of-sight limit in the extreme high-frequency ranges.

Both industry and the armed services anticipate savings through elimination of many relay stations

Radio propagation by forward scatter is believed to result from small inhomogeneities due to turbulence in the atmosphere. These inhomogeneities scatter radio waves in all directions, but predominantly forward.

LONG DISTANCES

With properly designed equipment, the scattered signal can be received over long distances along the earth's surface, even though the direct wave has gone off into outer space.

While this phenomenon has been known to science for several years, extensive research has been necessary before it could be successfully applied to radio communication.

For more than five years, forward scatter has been the subject of intensive experimental and theoretical investigation at the National Bureau of Standards.

The NBS program has included both ionospheric and tropospheric forward scatter.

Ionospheric scattering takes place in the lower part of the ionosphere —a region of electrified particles 40 to 200 miles above the surface of the earth.

Tropospheric scattering occurs in the part of the atmosphere that lies below the ionosphere.

Tropospheric forward scatter appears to be useful for transmissions over distances up to 600 miles, such as in air-to-ground communication between a plane in flight and its control tower, at frequencies from 100 to at least 10,000 megacycle second.

Ionospheric forward scatter mits communication in the freq range from 25 to approximate Mc, and over distances exte from approximately 600 to miles.

Beginning with frequencies radio waves are no longer ref by the ionosphere as they a ordinary long-distance tran sions, ionospheric forward sc extends into the very-high-freq (VHF) region, a part of the frequency spectrum formerly sidered useless for long-dis communication on a regular

HIGHER FREQUENCIES

In the regions where trar sion is by tropospheric scatte available frequencies are inc many-fold. Scatter propagatio helps to fill in gaps of path l that have not been satisfa covered.

NBS research in both area progressed simultaneously. tropospheric program has

d at Boulder, Colo., with the pal transmitters on Cheyenne ain near Colorado Springs and ing stations in eastern Colorado Kansas.

ionospheric work has utilised ety of paths to evaluate vari- such as the effects of the l zone. One of these paths— en Cedar Rapids, Iowa, and ng, Va.—has been used con- sly for nearly five years.

I—IONOSPHERIC

en radio waves were first dis- d, they were shown by physi- to be transverse electromag- waves identical to those of except for their frequency of ion. It was therefore believed ney would no more go beyond sible horizon than would light end around a corner.

ever, in thus simplifying the m, the physicists of that time ntly overlooked the fact that ays are reflected from mirrors hat they are scattered by at- eric irregularities such as or fog.

n Marconi demonstrated in hat radio waves could be re- across the Atlantic Ocean, was at first no satisfactory ation for his observations.

ch for such an explanation ally led Heaviside and Ken- to propose that high up in nosphere there are layers of ied particles, or ions, capable ecting radio waves much as or reflects light waves. Thus waves can be propagated far the visible horizon by re- from these ionised layers, collectively as the ionosphere. spheric reflection has been ars the basis of all radio cir- ore than a few hundred miles gth.

ering of radio energy by the here is similar to the scatter- light by small water droplets loud or fog.

n a beam of light shines the mist, moving points of re seen in the beam. These ater droplets, ordinarily too o be seen, scattering light out beam toward the observer.

arly irregular variations in ucture of the ionosphere are d to result in the scattering o waves.

pheric forward scatter is erised by its high reliability practically all conditions. auroral disturbances, which polar blackouts of ordinary equency ionospheric com- tion, scattered signals usually stronger.

FLARES

strengthening is often ob- during sudden ionospheric nces, which are associated olar flares and cause short- lackouts of high-frequency nication throughout the day- emisphere.

al storms and polar black- stitute one of the most seri- blems in arctic communica-

to attempts have been made n reliability during such dis- es by changing frequency of n. This, of course, requires installation of multiple transmitters, antennas, and receivers.

A single ionospheric scatter circuit, while expensive in itself, can provide more reliable service at a single frequency and less cost.

It is generally agreed that scattering takes place from that part of the lower ionosphere known as the E region. Ionospheric layers exist in this region at various heights, usually between 80 and 110 Km. above the earth's surface.

Ordinarily, radio waves (i.e., up to about 25 Mc) pass directly through the E layers and are reflected from outer layers, usually in the F region. However, there is some quality about the E region which causes VHF radio waves to be scattered in all directions when they strike it.

IONISATION SCATTER

This scattering can occur from a large number of small irregularities in the ionisation of the atmosphere much as light is scattered from the large number of small water droplets in a cloud or fog. A very small portion of the scattered energy will reach a receiver which is pointed directly toward the spot where the incident wave strikes.

This principle may be utilised for radio communication if (1) the radio wave is transmitted with sufficient power, (2) the transmitting antenna has high gain and is properly directional, and (3) a high-gain directional receiving antenna is used.

At least three major factors contribute to the ionisation of the E region, which causes ionospheric scatter: Direct solar radiation, corpuscular radiation, and meteors.

Corpuscular radiation, presumably of solar origin, consists of atomic particles of matter. These particles take from 18 to 30 hours to reach the earth from the sun.

When they enter the earth's magnetic field, they are caught up by it and spiral toward the pole. The net result is more ionization in the lower region of the ionosphere.

According to one school of thought, ionization by meteors is the dominant mechanism. Literally millions of tiny particles of meteor dust enter the earth's atmosphere every day but usually burn themselves out before striking the surface. Their passage through the atmosphere produces trails of intensely-ionized gas which scatter radio waves.

The meteor theory says that there are enough meteors to produce a continuous mechanism for propagation by the overlapping trails of ionization, and that this is the dominant contribution to the received signal. There is experimental evidence that this is true at some times of the day, particularly in the early morning hours.

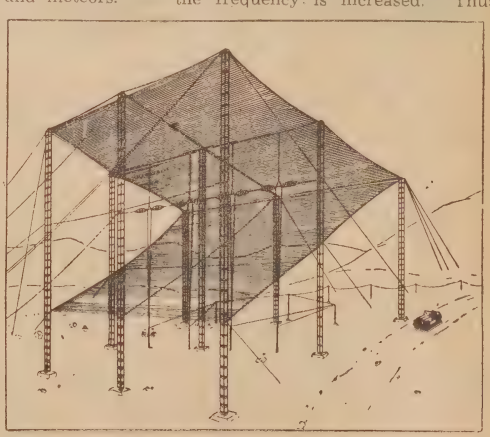
FREQUENCY, DISTANCE

The principal factors that limit the utilisation of ionospheric forward scatter are frequency and distance. The experimental approach has been to isolate the different variables and evaluate them individually. However, it has been difficult to express a relationship with frequency.

The useful frequencies are between 25 and 60 Mc. The signal strength falls off very rapidly as the frequency is increased. Thus the lower frequencies of the range will generally permit more efficient transmission.

However, if too low a frequency is chosen, ionospheric reflection will also take place at certain times, and then the scatter circuit may be affected by multipath propagation of its own transmission or by other transmissions, or it may cause interference in other circuits.

Distance dependence is governed largely by (1) the magnitude of the scattering angle, and (2) the height of the layer of the ionosphere that produces the scatter. The scat-



Large corner antennas designed and constructed by E.C. Page, Consulting Radio Engineers, in co-operation with NBS, are being studied for effectiveness in comparison with other types of antennas. Note size in relation to automobile.

The contributions of each mechanism are not known exactly and need more study. Some observations, however, seem to identify behavior noted at different times with specific mechanisms.

In a series of measurements over an arctic path (Anchorage to Barrow, Alaska) correlation with magnetic activity indicated a rise in signal strength at the receiver with increasing magnetic activity at the midpoint (Fairbanks).

One explanation is that the contribution of the corpuscular radiation factor at these times is high.

Trail of wreckage left by the 1955 Maitland flood.

An Invisible Lifeline . . .

The worst flood in the history of the white man in Australia swept down the Hunter River Valley in early '55, causing death, privation and misery to thousands of people.

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This "invisible lifeline" was operated from central emergency stations with equipment no bigger than the average radio cabinet.

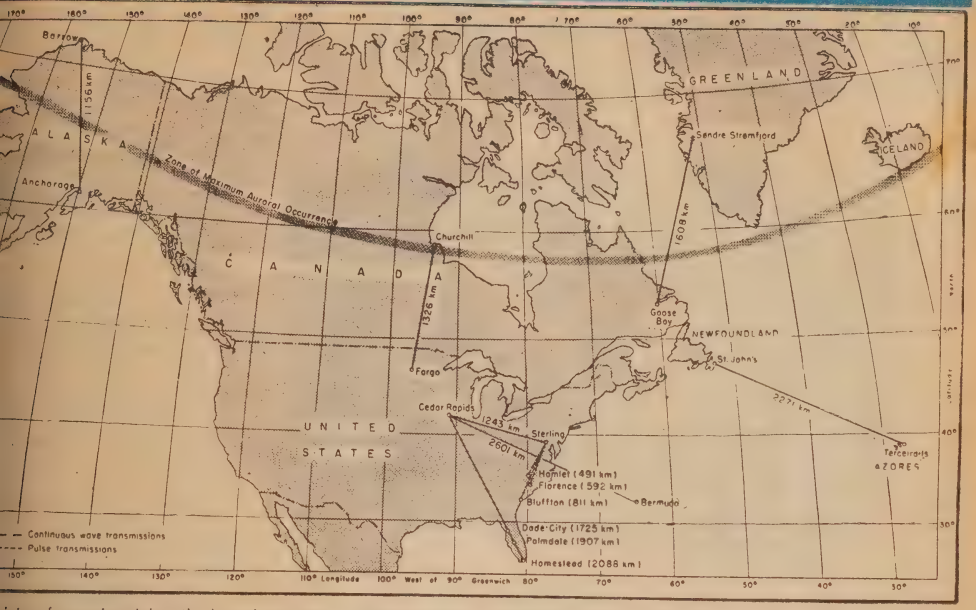
Technicians used 10-watt and 3-watt frequency modulation equipment, making contacts up to 40 miles away.

As the water receded, radio men gave valuable assistance, before tele-communications were restored, by relaying messages and directions throughout the area.

Scientific developments are constantly helping radio men everywhere to improve their techniques and equipment.

SHELL research, for instance, has produced from petroleum special resins used for wiring, insulation and condenser sealers in every type of radio set.

VHERE THE FORWARD-SCATTER TESTS WERE MADE



riety of experimental paths have been used in NBS studies of ionospheric forward scatter. The original path between Cedar ls, Iowa, and Sterling, Virginia, has been operating continuously since January, 1951. Three paths crossing or terminating e zone of maximum auroral occurrence afforded an opportunity for study of auroral effects. The path from Newfoundland e Azores (1141 miles) was selected to study problems associated with extreme distance. Other parts were utilised for experiments with such variables as distance dependence and height of the scattering layers.

ngle is defined as the angle en the incident wave and the ed wave that reaches the er.

bserved in the NBS tests, the th of the scattered signal falls ry rapidly as the scattering is increased. This occurs as th is shortened. At less than 500 miles the ionospheric becomes too weak for prac- se.

he longer distances, the signal ty is usable because the angle ll, until the limiting distance hed.

maximum distance is reached the portion of the ionosphere which scattering occurs meets orizon as "seen" from the itter. Increasing antenna helps slightly toward increas- distance range.

13 Kennelly suggested the pos- that radio waves might be ed as well as reflected by the here. In 1932 Eckersley pro- a theory of scattering to ac- for certain special effects he ed, but no one appears to eriously proposed ionospheric ing as a useful communica- echanism until 1950.

E IT STARTED

ecember of that year a group io scientists holding a con- at Massachusetts Institute of logy suggested that scatter- the ionosphere might produce l sufficiently strong to be use- ovided a strong transmitter, high-gain antennas, and a sensitive receiver were used.

A co-operative experiment was promptly arranged in which the MIT Lincoln Laboratory sponsored operation of a transmitting site by the Collins Radio Co. at Cedar Rapids, Iowa, while the National Bureau of Standards operated a receiving site at its field station at Sterling Va. The distance is 773 miles.

After experimental transmissions during the next month had demonstrated that signals were continuously received and that they exhibited interesting and promising behavior during ionospheric disturbances, a program of further experimentation was formulated.

Transmisions on 49.8 Mc over the original path have continued without interruptions since January 23, 1951.

The program has subsequently been enlarged in various ways, but always with the dual objective of (1) investigating the physical principles and theories involved in ionospheric scatter, and (2) providing engineering information for the design, construction, and operation of communication systems.

Since the method offers the advantage of reliability during ionospheric disturbances such as auroral storms and polar blackout, three paths were established in regions where the aurora is most active.

The investigators found that with careful design of the path components, it is possible to communicate with very high reliability even in those regions where communication by ionospheric reflection is often badly disrupted by natural phenomena.

EXTREME DISTANCE

A path from St. John's, Newfoundland, to Terceira Island in the Azores gave an opportunity to study problems associated with extreme distance — 1411 miles in this case. Here the terrain was such that high antenna sites could be chosen overlooking the ocean.

Under these circumstances it was verified that a distance of 1400 miles is feasible for reliable operation.

In 1952 and 1954 short-distance tests were made from Sterling, Va., to Bluffton, SC. In these tests the time of arrival of ionospheric scatter waves was compared with that for more direct tropospheric signals. This gave direct evidence concerning the height of the scattering layers.

In 1951 an attempt was made to look for scattering from higher layers such as the F2, on a path from Cedar Rapids to Bermuda. This path was chosen as being sufficiently long so that the lower layers would be well beyond the horizon.

OCCASIONAL SIGNALS

At the frequency used — near 50 Mc — occasional weak signals were observed, and these were attributable to other mechanisms.

As part of the United States participation in the International Geophysical Year, it is planned that NBS will carry out in 1957-1958 an iono-

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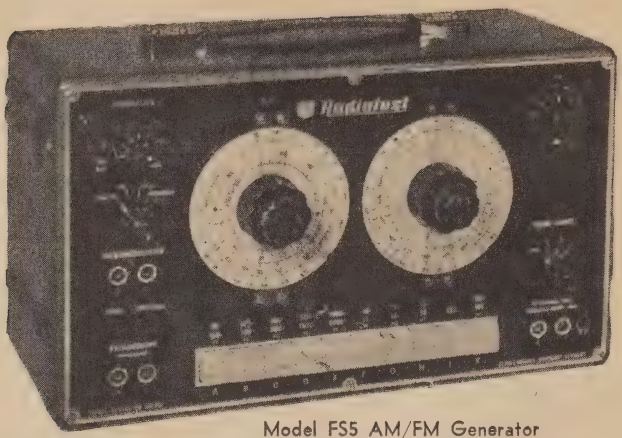

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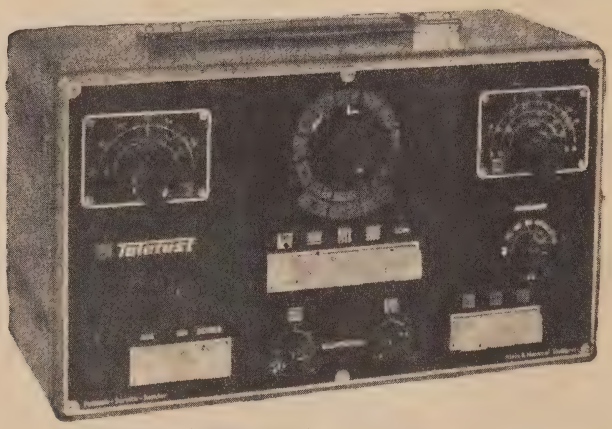

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c scatter experiment in Peru, the midpoint of the path will rly at the geomagnetic equator. s experiment will determine ring behavior in a geographical having ionospheric character- not previously studied from the ring standpoint. The possibil- high-level scattering in that will be investigated.

ge rhombic antennas have been at both ends of the path for of the experiments. Where and suitable terrain were not ble for rhombics, Yagi arrays isually substituted.

mbic antennas up to 25 wave- s on a side have been con- d. For a frequency of 50 Mc rimately that used on all paths Newfoundland-Azores, this 500 feet on a side.

struction and successful ap- on of antennas of such size ned that conventional design nbic antennas could be extend- larger sizes.

rder to study antenna patterns help in predicting perform- caled systems were construct-

e only a small portion of the itted signal is scattered by the here, it is necessary to use amounts of gain in a com- ation system. This calls for ul transmitters, high-gain as, and sensitive receivers. The ng circuits that have been d use 40-kw transmitters, ain antennas, designed by NBS nsitive receivers designed by Lincoln Laboratories.

omplete 4-channel multiplex eletype system began opera- 1953. After a brief trial the prototype circuits were vailable to the Air Force for affic. A careful attempt was to obtain accurate perform- eports and to provide informa- the problems and weaknesses e facilities.

he first year, traffic utilisa- as achieved 91 pc of the time. ation difficulties accounted for disruption 1.1 pc of the time.

II—TROPOSPHERIC ARD SCATTER

fairly recently, distances beyond the horizon of a radio itting antenna were consider- great for useful communica- nks at frequencies above 100 cles per second, and distances n 1000 miles were considered rt for good ionospheric pro- n.

just this range of distances s important in the application ard scatter techniques.

he propagation paths between 1200 miles, only the iono- will support measurable scat- nals.

ver, for distances shorter out 6000 miles and at fre- s above 100 Mc, observed signals are tropospheric.

sefulness of the ionospheric mechanisms ceases at about while tropospheric propa- romises to be useful for com- ion purposes from 60 Mc up encies exceeding 10,000 Mc. ionospheric scattering, tropo- scattering is caused by small eneities in the atmosphere. r, in tropospheric scattering dent radio energy does not he electrical properties of the medium (except in the centimetre-wave region, where absorption effects are important).

Thus, in contrast to ionospheric scattering, tropospheric scattering is not very frequency-sensitive.

At frequencies above 50 Mc, climate, weather, and terrain irregularities play principal roles in determining the strength of a tropospheric signal and the distance it will be propagated.

Above 1000 Mc (or below a wavelength of 30 cm), effects of atmospheric absorption become apparent; and at wavelengths of a fraction of a centimetre atmospheric absorption is by far the most important factor in the transmission loss or attenuation between transmitting and receiving antenna terminals.

Radar meteorology makes good use of these absorption phenomena.

World War II accelerated development of techniques and applications for the portion of the radio frequency spectrum above 50 Mc, which include radar, aircraft communications, navigational and guidance systems for aircraft, ground-to-ground radio relay systems, a new system for broadcasting using frequency modulation, television, and many other services.

CO-ORDINATION

At the close of the war the Central Radio Propagation Laboratory was established at the National Bureau of Standards to centralise and co-ordinate radio propagation research.

Current interest in tropospheric forward scatter is due in part to the economic advantage of long-distance radio relays, which eliminate a great many expensive relay stations. Many advantages accruing from basic research in this field by NBS and other laboratories come from an increased understanding of propagation.

For instance, determination of random phase variations of signals on line-of-sight propagation paths at VHF and UHF reveals some of the limitations imposed by the propagation medium on accurate direction-finding systems.

NBS activities in the field include investigations of such quantities as transmission loss, fading rate, fading range, phase variations, angular distance, obstacle gain due to diffraction, and path antenna gain.

Transmission loss is defined as the ratio of power available from the receiving antenna to the power radiated from the transmitting antenna.

This quantity has been used since 1952 to record the results of investigations at NBS because one of the characteristics of scatter propagation is that the system will not realise the gain of the antennas. Therefore the usual specification of field strength in terms of effective radiated power is likely to be misleading.

FADING RATE

Fading rate, the number of times per minute that the envelope of a received field crosses its medium level with a positive slope, is a useful quantity in studying propagation either by diffraction or by scatter. Fading may conveniently be classified into long-term and short-term variations of transmission loss.

Long-term variations are caused by slowly varying changes in the propagation medium such as changes

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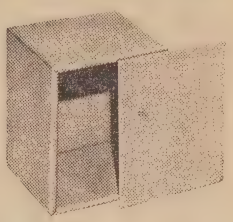

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e intensity of turbulence in the sphere.

ort-term changes are attributed ase interference among simul-usly occurring modes of propa-n, that is, to multiple path s. Recent work has indicated ading rates within this line of are independent of frequency depend upon the number of spheric inhomogeneities or s" that cross the propagation each minute.

rumentation has been de-d to measure variations in the difference of waves travelling ngle path and of waves travel-n multiple paths.

UL PARAMETERS

ain geometrical parameters been found useful in develop-nethods for predicting trans-n loss under a variety of con-.

of the most important of these angular distance, defined as ngle in the great circle plane en the horizon rays from the nitting and receiving antennas ermined for a radio standard phere—that is, using an effec-adius of the earth 4/3 times ual value.

a smooth spherical earth the r distance is equal to the dis-between the radio horizons of ansmitting and receiving an-divided by the effective rad-the earth.

difficult problem of defining a height over irregular ter-ecomes less important when r distance is used as a para-

ng range is the difference in s between the instantaneous ission loss levels that are ex-90 pc and 10 pc of the time a short period such as one

convenient to consider re-VHF and UHF fields as con-essentially of two compon-

has a slowly varying ampli-nd results from some mech-such as ground wave propa-within the horizon or diff-accompanied by ducting or on from elevated layers in ation beyond the horizon. An-component has a rapidly fluc-amplitude and results from heric scattering.

CTION

veloping scattering and diff-theories it is important to le to separate these two isms from the observations. use of angular distance in ing transmission loss and range for propagation through lent atmosphere over irregu-ain has provided a set of pre-formulas which agree very with observed 6-month med-ues.

observations include some hourly median values of ssion loss, over 122 propa-paths at frequencies ranging 5 to 1046 Mc.

obstacles which act like knife edges in ground-to-propagation paths can effec-educe transmission loss and below the amount observed e forward scatter mechanism. urements have been made on several paths approximately 100 miles long one of which passed over Pike's Peak at an elevation of 14,109 feet above sea level.

When transmission was directly over the summit of the peak, the signals were much stronger than when the path passed on either side. Very little fading was observed in this location.

Transmission loss over a knife edge is systematically less than that for propagation over a sphere, indicating the desirability of developing a method of calculation applicable more generally to obstacles of intermediate shapes.

Such a method has been developed, depending upon the fact that transmission loss over a smooth sphere with distance and angular distance constant decreases rapidly as the effective radius of the sphere becomes less.

PART III — Causes and theory of propagation by scattering due to turbulence.

The Bureau's experimental research on tropospheric and ionospheric scatter mechanisms has been accompanied by a study of the causes and theory of scattering due to turbulence.

This subject involves many different aspects which must be pieced together. Some are related to the dynamics of the turbulence itself: What produces the density fluctuations involved? What are their amplitudes and their sizes? Can their distribution be obtained deductively without special hypotheses from general meteorological information such as distribution of winds, temperature, and humidity?

OTHER ASPECTS

Other important aspects are related to the electromagnetic theory; how the scattered field is affected by the distribution of fluctuations in the atmosphere. Relatively little has been published on these problems, and it is only very recently that a satisfactory theory has been achieved.

This account gives the principal results of recent NBS work, still in great part unpublished.

In sort, it appears that the Bureau's work provides a theory capable of describing in detail both the turbulence and the resultant scattering. Such a theory will permit better radio propagation predictions and should aid in the development of improved transmission systems.

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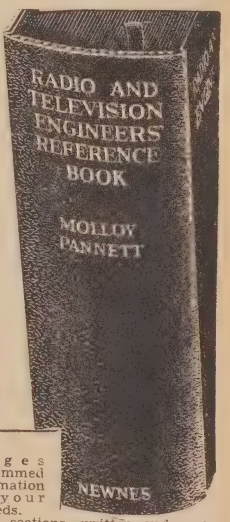

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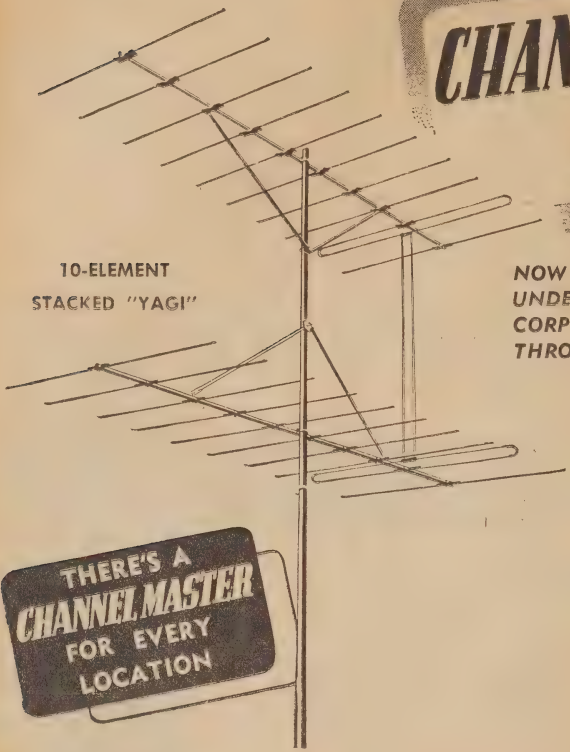

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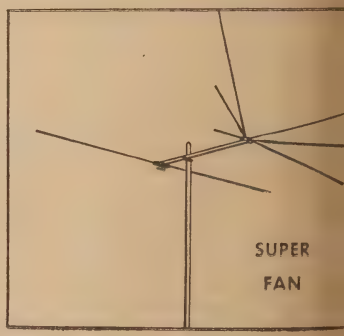

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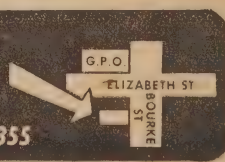

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ose wishing to extend their ge of magnetic recording, a ensive bibliography is in-

o the strictly non-technical e the book will have con- e appeal to the home record- thusiast. Nevertheless the does not suffer from this t of the subject and the uld also be a valuable guide fessional users of magnetic g equipment.

FIDELITY HOME MUSIC IS. A Trend book, Trend ated, Los Angeles, USA. /6.

hi-fi enthusiast accumulates amount of equipment over s and after a while it be- uite impossible to accom- all of it in a cupboard, to out and used as required. cing of loudspeaker systems become quite a problem, rly where space limitations ermit the use of bulky en-

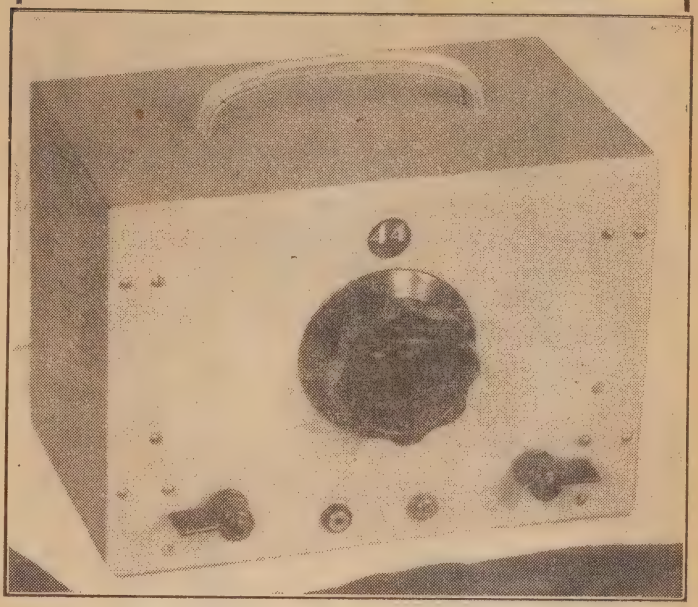
esent book suggests no less ifferent ways of overcoming oblems by incorporating a t installation of high quipment in built-in furni-

iter discusses fully the prac- of each approach. Layout , schematic diagrams and a mber of photographs of stallations accompany each discussed.

gh the author deals largely erican equipment, there is why locally manufactured t could or should not be the same manner.

ook promises considerable to anybody contemplating hi-fi system.

WATCH OUT FOR THIS NEXT MONTH



IN our next month's issue we plan to discuss in detail the construction of a reliable and inexpensive photographic timer, as pictured above. Using two receiving type valves and a minimum number of critical components, the circuit is no more complicated than that of a regenerative receiver, and anybody handy with the soldering iron should be able to construct it without difficulty.

By choosing suitable constants the instrument is capable of giving exposure times from 1.4 to 64 seconds at better than 1pc accuracy. This range is covered in 12 steps, each step representing an increase of 1.4 times in exposure. Each alternate step corresponds to an increase of 2 times. It is thus in line with normal photographic practice.

Small size, a minimum of controls and an internally illuminated scale make the instrument particularly suitable for darkroom use. The large centre knob contols the exposure time, the left hand lever allows continuous exposure whilst the right hand control starts the timing cycle. Tip jacks on the front panel allow the use of a foot switch or other remote control.

LOW COST HI-FI, by D. C. Hoefler. A Fawcett "How-To" book. Price: 8/6.

Many a music lover would like to improve upon his record playing equipment but is deterred from doing so by the comparatively high cost of high quality equipment. Home construction is one way of getting suitable equipment, but the beginner is likely to run into trouble here due to lack of experience.

The author sets out to explain and prove that high fidelity must not necessarily mean high cost. Profusely illustrated, the book gives a very good picture of what should and what should not be expected from commercially-made equipment and how to make the best from available items.

Unfortunately the book deals almost exclusively with equipment available only in the United States so that it does not fulfil its prime purpose of suggesting suitable equipment to buy as far as Australian readers are concerned.

Nevertheless the principles regarding equipment apply equally to other brands not mentioned in it and the book should at least give some idea what to look for on the market, if the purchase of ready-made equipment is contemplated.

Our copies of the above three books from the Technical Book and Magazine Co., 295-299 Swanston St., Melbourne, C.1.

Bombproof broadcasting

THE first radio station to be completely immune to an atomic attack has been opened in Sweden.

The two-storey station with its transmitter is built inside a giant cave blasted deep into rock outside Stockholm.

No staff are required. Programs can be switched on and off from the Swedish State radio headquarters in Stockholm, six miles away.

Two red and white steel aerial masts are the only part of the station above ground.

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HAS COMPLETELY INSULATED OUTER COVERING

Whether you want to saw wood, polish your car, dr grind, sand or buff, this amazing electric drill and attac ment Tool Kit will do it in HALF THE TIME. It is t answer to every man's problem—a complete portable pow workshop that packs in a small lidded metal case—easy to use, light in weight, safe—absolutely shockproof, and supplied with a Full "Home-workshop" attachment Kit, including Circular Saw with fence rail and grooving, rebating attachment, drill stand, set of bits, grinding wheel, polishing wheel, wire brushing wheel, rubber backing disc for sanding and polishing, and a range of sanding discs and polishing pads.

It's so quick, so easy—requires no experience. Simply plug in the extra long lead and it's ready for use, in your home, up on the roof, or polishing the car—wherever the job might be. And it's priced right down to suit your pocket. The cost is just 7/6 weekly or £24/9/6 cash. Here's your chance to—

- ★ Do every odd job at home QUICKER.
- ★ Make and repair furniture EASIER.
- ★ Clean and polish your car BETTER.

Sent To You on 7 DAYS' FREE TRIAL

Now you can prove it yourself — test this amazing shockproof Drill and attachment kit at your home, under any conditions you like — and if it does not save you time and do an infinitely better job, it COSTS YOU NOTHING —not one penny. Simply return it, and your money will be immediately refunded. Yes, satisfaction or money back is guaranteed. Just think of it — no more tiring, boring sawing, polishing, sanding or grinding, satisfaction assured and 12 months' guarantee. But hurry—this offer may never be repeated. Mail the coupon for full particulars without obligation today—do it now.

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The demand for Sher Drillmaster Kits is so great that only limited supplies are available from time to time. We expect present stocks to sell out in 2 to 3 weeks. To avoid disappointment, you are advised to mail the coupon for full particulars without obligation, or call and inspect these famous Home-workshop Power Tool Kits as soon as possible. NOTE: This special 7-DAY FREE TRIAL OFFER is available only from—

SAMPSONS ENTERPRISES PTY. LTD., Dept. H5, 481 Kent St., Sydney (Located behind Sydney Town Hall.)

RUSH THIS COUPON NOW

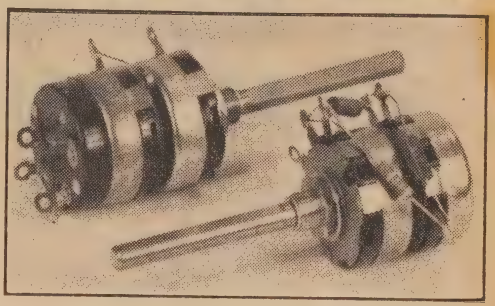
SAMPSONS ENTERPRISES PTY. LTD., Dept. 481 Kent St., Box 4184, G.P.O., Sydney.
(Location—In Kent St. behind Sydney To Hall.)
Please send full particulars of Sher Drill a ttachment Kit. I enclose 3½d. postage stan

Address .....

TRADE REVIEWS AND RELEASES

C LOUDNESS CONTROL AIDS LOW-LEVEL LISTENING

essrs. Wm. J. McLellan & Co. Pty. Ltd. have recently eased a "Loudness Control", intended to take over function of volume control in domestic receivers and uncompensated audio amplifiers.



The new IRC Loudness Control. Built around a standard ganged potentiometer it employs a compensating network to accentuate bass and treble response at low levels.

'HOUGH both types of control erve to vary volume, the loud- control has an additional func- -that of altering the tonal bal- as the volume is varied. A e volume control does not do

loud volume, the response of uman ear is substantially uni- with frequency but, as the ne level is reduced, the loud- of bass and treble tones ap- to diminish faster than the e frequencies. Thus, low- listening may seemingly be cterised by a predominance of les".

elaborate equipment, this can fset, if desired, by manipula- tion of the bass and treble controls but such facilities do not exist in a simple receiver or amplifier.

A loudness control combats the effect by introducing compensation which varies in its effectiveness with the gain setting. It automatically imparts bass and treble boost at low levels, the boost diminishing as the control is advanced.

The IRC Loudness Control is built around their standard ganged potentiometer. One section is tapped and a number of resistors and capacitors are used to interconnect the sections. The control can be supplied with or without switch.

Provided space under the chassis permits, it can usually be installed in place of an ordinary volume control, the leads being transferred from one to the other, according to an instruction sheet available from the manufacturers.

Tested by us in an ordinary mantel receiver, one of the new loudness controls made a very definite contribution to quality at low listening levels.

GRAMPIAN USES MULLARD CIRCUIT

Mullard "5-10" amplifier cir- is now well known and one rcial version of it is that by Grampian Reproducers England). A sample sub- for examination proved to l made and attractively fin- As is customary these days. rate control unit is used for icy compensation, &c.

es used are the EF86 as high- put stage, direct coupled to C83 as a phase splitter, and 4's as the output stage. The is a GZ30.

basic amplifier is rated at 10 with a response from 10 cps 0 cps within plus or minus Tested in our laboratory it performed very well and the makers' claims appear to be substantiated. The response is essentially flat throughout the audible range with a very slightly rising characteristic to 40 Kc, rolling off smoothly thereafter.

The performance is also very good at the bass end, the full power output being maintained to below 30 cps without any sign of break-up or obvious distortion. Allowing some reduction in power, the bass response extends even lower.

Square wave tests at both 1 Kc and 5 Kc showed the ringing to be well controlled, which was more or less expected in view of the smooth frequency response.

BALLAST CHOKES

THE latest addition to the range of National transformers and similar products is a range of fluorescent ballasts. Typical of these is the National AC404, rated at 420 mA and intended for use with 40 watt fluorescent tubes.

The ballast is made in accordance with the Australian, British, and American standard specifications for fluorescent ballasts, all of which are particularly stringent.

This ballast was exhaustively tested by the Sydney County Council, the tests including deliberate overload to simulate a shorted starter switch, and insulation and breakdown tests after being subject to standard humidity conditions.

The overload caused a temperature rise of 86 degrees C., against a permitted rise of 105. The breakdown test of 2 KV for one minute was passed and the insulation resistance was measured at 15 megohms, against a permitted figure of greater than 1 megohm.

All the other tests, some of which are quite intricate, were passed with considerable margin of safety and the unit would appear to be of first-class construction and workmanship and well up to the standard established by previous National products.

RADIO TRADESMEN

For work on the
installation,
testing
and repairs
of radio and radar
equipment
on
Military aircraft

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VIBRATION PICK

The makers of the well-kn
Acos microphones and pic
have recently announced an
teresting addition to their ra
a vibration pickup which sh
find many applications in
industrial and musical sph

KNOWN as the VP1 it is a
ture vibration pickup with
sensitivity and an unusually
frequency response from 30
cps. It has been designed
with musical instruments,
ticularly of the stringed type.
their output can be electrical
plified.

The output voltage is from
.1 volt or higher, and the size
long by ⅜in wide by ¼in thick
construction is robust, a m
rubber case protecting the
from damage. As with all Acos
the crystal is processed with
tective coating to withstan
effects of humidity. However
peratures above 50 degrees
grade should be avoided as th
destroy the crystal.

The VP1 is supplied with
cable and is intended to be co
directly to the input grid cir
the amplifier. Ideally this
have an input impedance of
ohms.

Further details, price &c., fr
local agents, Amplion (Aust
Ltd., 36 Parramatta Rd., C
down, NSW.

SCOTCH TAPE

WM. J. McLELLAN & CO
LTD. advise that the popu
33 Scotch Electrical Tape, pre
only available in 66ft rolls
available in job size rolls
This tape is particularly suita
TV aerial installation since it
affected by weather and will
stand temperatures up to 1
grees F.

RADIOTRON VALVES, COMPONENTS FOR T.V. RECEIVER

latest issue of Radiotronics
ies a list of preferred valve
es recommended by the
lgamated Wireless Company
use in Australian-made tele-
n receivers. A number of
deflection components are
being made available to
ate in conjunction with the
mmended range of valves.

company points out that the
e of components as well as
represents a departure from
olicy but the question of de-
n and EHT supply is so closely
to the picture tube itself,
is only logical to market the
t components. They are suf-
in fact, to put a raster on the

idual valve types, picture
nformation and the range of
ted deflection components are
d below:

ING TYPE VALVES

GT: Half-wave high-voltage
r. Important features of the
T are its low-wattage filament
olts at 0.2 amps) and its low
-filament capacitance.

: Directly heated full wave
rectifier. The high rectified
-rating of this valve, e.g.,
A DC with 300 volts per
nakes it a suitable single rec-
or the majority of TV re-

: Miniature twin diode. A
rmeance type especially suit-
M and video detection.

: Low-microphony beam
amplifier for audio power
and vertical deflection cir-

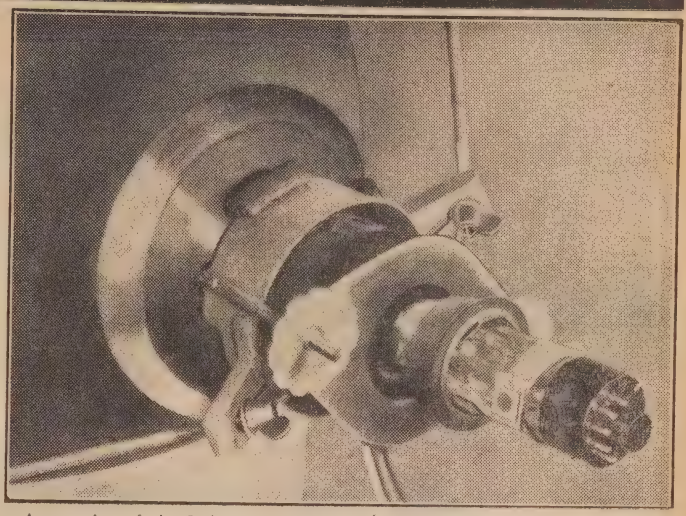
: High gain pentode for use
und IF amplifier. It may
used in gated AGC circuits.
Duplex-diode-triode AF
r. The diodes may be used
AGC clamp in delayed AGC

-GT: Half-wave damped
A high-current quick-heat-
e of adequate size to dis-
e heat generated in damper-
ervice in TV receivers.

A: Medium-mu twin triode.
-transconductance type es-
designed for cascode opera-
n low input capacitance, low
oading and low plate-to-
capacitance.
Video IF amplifier pentode.
pacitance values combined
h mutual conductance give
6 a high wide-band factor.

TB/6CU6: Horizontal out-
n power valve. A structure
uards against emission from
ds and provides for maxi-
ssipation of heat from the
conjunction with a design
high ratio of operating plate
en current, enables the
B/6CU6 to deflect picture
aving deflection angles up
y degrees.

TA: Twin triode. Especially
to give stable, reliable
n throughout life in vertical



A rear view of the Radiotron 17HP4B 17-inch picture tube, assembled ready for operation. Simplicity and efficiency are claimed for the electrostatic method of focusing used in this tube, which also features an aluminised screen.

and horizontal oscillator circuits. The 6SN7GTA may also be used in multivibrator, phase inverter and other TV circuits.

6U8: Triode-pentode converter. Oscillator-mixer valve with separate triode and pentode sections, having particularly high triode transconductance. The individual sections of the valve may be used for independent functions, e.g., pentode as sound IF amplifier, triode as sound AF amplifier.

12AU7: Medium-mu twin triode. A miniature type for use in circuits in which the stability of the 6SN7-GTA is not required.

12BH7: Medium-mu twin triode. A miniature combined vertical oscillator and output valve of adequate size for picture tubes up to ninety degree deflection angle, when operated from the boost supply voltage.

12BY7: Pentode video amplifier. Very high mutual conductance at low plate current, together with low capacitances, give the 12BY7 a remarkably high figure-of-merit as a video amplifier.

PICTURE TUBE—TYPE 17HP4B

This is a 17 inch, 70 degree, electrostatic-focus, aluminised tube with filter-glass face plate, designed for EHT voltages up to 16 KV.

An electrostatic-focus tube was chosen so that full advantage can be taken of the Australian 625 line system, practical experience having shown that electrostatic focusing makes best use of the available definition over the whole face of the screen.

Not only does electrostatic focusing provide the best picture, but it also dispenses with the need for an expensive and weighty focus magnet assembly. This is replaced by a simple centring magnet.

Further important considerations are—simplified receiver adjustment on the production line, the maintenance of accurate focus adjustment during shipment of completed television receivers and automatic focus compensation for supply voltage variations.

Aluminising was adopted because of its obvious advantages. The mirror action of the aluminium film behind the phosphor minimises diffusion of light from high-lights in the picture to darker parts and thus provides better contrast.

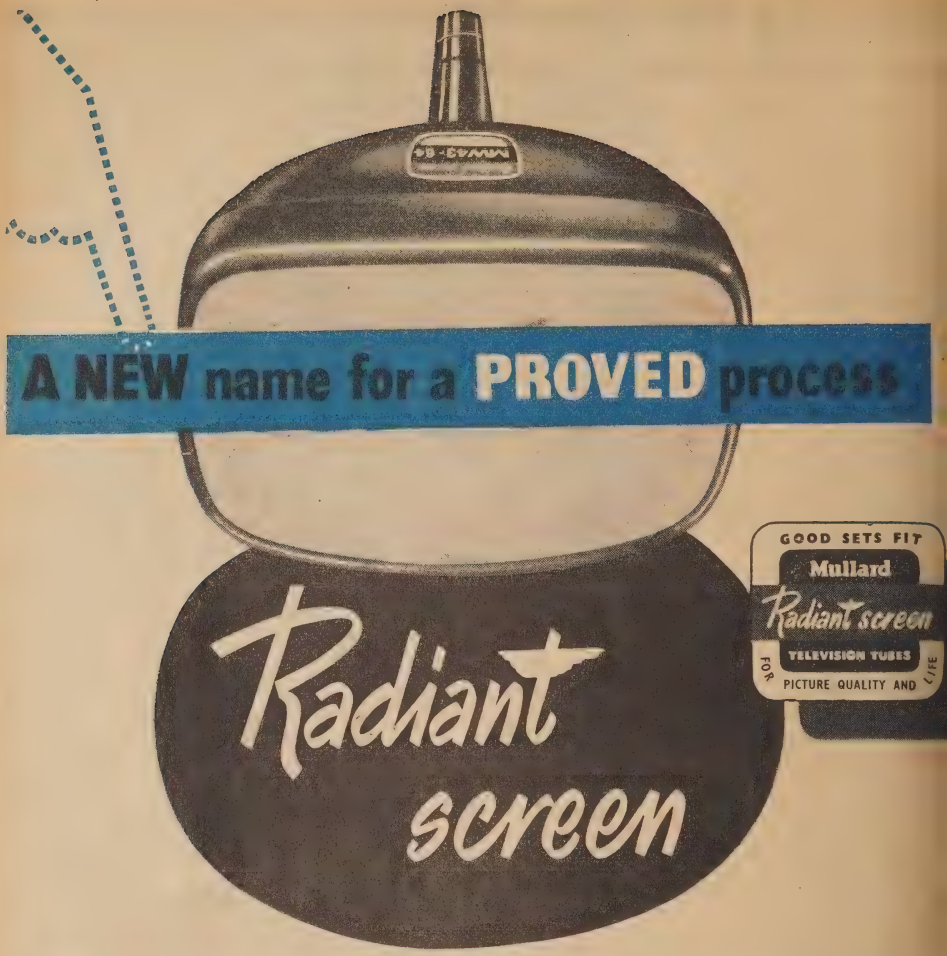
While adequate brightness may be available without aluminising, the additional brightness provided by aluminising at high EHT voltages makes it possible to use a filter safety-glass in addition to the filter-glass face plate on the tube and thus to obtain blacker "blacks" in the TV picture and also to minimise a "washed out" appearance in conditions of high ambient lighting.

SPECIAL COMPONENTS

To ensure that complete satisfaction will be obtained from the Radiotron range of valves and picture tubes, the A.W. Valve Co. is also making available a range of components for use in the deflection circuits of a TV receiver.

These components are those necessary to produce a raster on the screen of the picture tube and are:—

	Code No.
Horizontal Sine Wave Coil	CHS1
Horizontal Width Coil	CHW1
Horizontal Blocking Oscillator Transformer	THB1
Horizontal Output Transformer	TH01
Horizontal Linearity Coil	CHL1
Deflection Yoke	Y70D1
Ion Trap Magnet Assembly	MIT1
Centring Magnet Assembly	MCA1
Vertical Blocking Oscillator Transformer	TVB1
Vertical Output Transformer	TVO1



There are a host of convincing reasons for the consistent quality and long life of Mullard Picture Tubes. One feature, however, is all-important — the fluorescent screen. The subject of years of research, this screen — in many respects unique — is a major distinguishing feature, and so that it may be recognised as such, Mullard have adopted a new term — RADIANT SCREEN. Millions of Mullard RADIANT SCREEN Long Life Picture Tubes are in service in Great Britain. Soon RADIANT SCREEN Picture Tubes and the superb Preferred range of Mullard TV valves will be providing Australian viewers with the finest picture presentation. *As in England — good sets will have . . .*

Mullard Radiant screen

Mullard

TELEVISION TUBES

for Picture Quality and **Life**

MULLARD-AUSTRALIA PTY. LTD., 35-43 CLARENCE ST., SYDNEY, BX2006. 592 BOURKE ST., MELBOURNE, MU2366.
ASSOCIATED WITH MULLARD LIMITED, LONDON, MULLARD OVERSEAS LIMITED

USEFUL NEW ITEMS FROM PHILIPS

nples of a convenient new type valve socket and shield are to hand n Philips Electrical Industries. Also received from Philips, are ples of Ferroxcube beads, which will find many applications in modern high frequency equipment.

insulating
terial used
sockets is
mic which
ing to the
u facturers
ins its low
operties up
) Mc. In-
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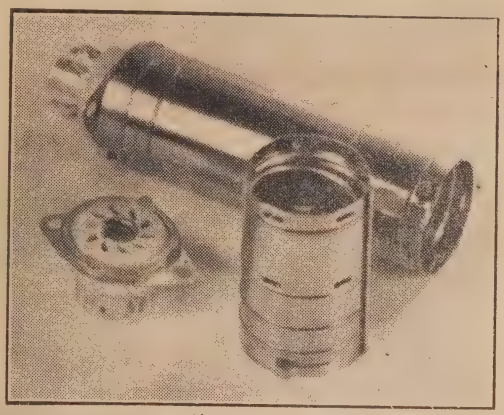
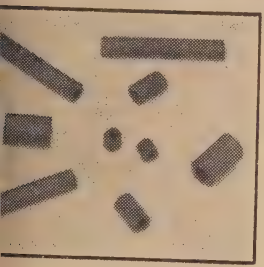


Above: The new sockets with shield cans. Left. A selection of Ferroxcube screening beads.



s that it is equally suitable with or without the shield The socket proper is fitted o small lugs which are integral with the metal l for the ceramic body. The no higher than for a normal making no provision for a

efore, a shield proves neces- er assembly it can be added disturbing the wiring.

ickel plated brass shield can with a cadmium plated which ensures that it holds e firmly and safely under is of vibration and shock. is available in five differ- ths.

ve decoupling between compact electronic equip- erating at high frequencies ning more important as it in complexity.

and high tension leads are cause of trouble, particular- rmer where it is very dif- make the impedance of a apacitor low enough and ance of a choke would not ible, quite apart from the

cube ferromagnetic material ade to have a high perme- d at the same time a high gh frequency. If, therefore, the material are placed ffending wire, coupling will d both because the induc- he lead is increased and the

unwanted energy is dissipated in the screening material.

Bypass capacitors can be used to increase the effectiveness of the beads.

POTS FOR SIGNAL INJECTOR

RESPONSE to the recent article on a probe type Signal Injector was such that available stocks of miniature Morganite potentiometers were rapidly exhausted. Many readers were therefore disappointed.

However, Messrs. Watkin Wynne have arranged for additional supplies of these potentiometers to be available immediately, ex stock. Constructors may therefore ask their supply house to order a control through Watkin Wynne Pty. Ltd., 173 Pacific Highway, North Sydney. Alternatively, if difficulties are encountered, the controls may be ordered directly.

Watkin Wynne are also arranging to supply the probe housing and potentiometer together, where both are required to construct a Signal Injector.

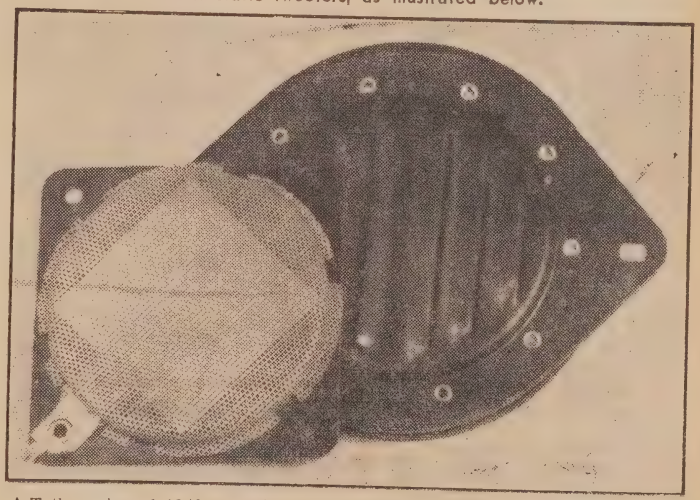
CHASSIS FOR R, TV & H PROJECTS

Blueprints of the chassis for receivers, amplifiers, test equipment, &c., described in these pages are prepared as a matter of routine and copies passed on to chassis manufacturers. These blueprints are also available to readers under the conditions set out on the query page at the back of this issue.

Ready punched chassis should be ordered from your usual radio supplier who will, in turn, order them in bulk from the manufacturer. Quote the name on the schematic circuit.

ELECTROSTATIC "TWEETER" SPEAKERS

Audio Engineers Pty. Ltd. have recently landed supplies of Lorenz electrostatic tweeters, as illustrated below.



AT the price of 12/6 or 22/6 each, according to type, they should be attractive to those who like to experiment with such devices. Sensitivity of the tweeters is not high but they can readily be added to simple amplifier set-ups, particularly single-ended amplifiers, to add a touch of sparkle to the extreme treble.

Despite their asymmetrical structure, the speakers appear to have a smooth response and are free from obvious distortion or buzzing effects.

Also of interest to experimenters is the fact that they operate quite efficiently as condenser microphones, with the provision of a polarising voltage and a coupling network to the preamplifier grid.

A COURSE IN TELEVISIO

PART TEN . . . RECEIVER "FRONT-END" DESIGN

Having gained some appreciation, last month, of the major sections in a modern televisio receiver, we now proceed to examine each of the sections in turn. Logically, we begin with discussion of the "front-end" circuits

IN discussing a conventional receiver, the normal approach is to consider the RF stage separately, then the mixer and oscillator. Apart from the fact that they are usually located close together on the chassis, and share a common tuning capacitor, the stages are not especially interdependant.

In a television receiver, however, the position is quite different.

Because of the way the channels are allocated, the signal frequency circuits must operate in the VHF spectrum and over a wide range of frequencies. These requirements present notable design difficulties, both electrical and physical.

Extreme care must be exercised in the choice of valves and their operating conditions. Lead length and capacitance must be kept to an absolute minimum and active precautions taken against frequency drift due to voltage change, to temperature or to mechanical stress.

These requirements cannot easily be met by a group of components assembled on to the main chassis, as is the custom with conventional broadcast receivers. It leaves too much room for latitude in wiring and assembly methods.

TUNING UNITS

Instead, normal practice is to construct the tuner as a distinct unit on its own sub-chassis. This incorporates the complete tuning mechanism for input, mixer and oscillator circuits, interference "trap" circuits, all necessary shielding, the RF, mixer and oscillator valves, all bypass and supply components and any necessary provision for temperature-drift compensation.

In addition, the tuner may incorporate the first IF transformer or loading coil, so as to obviate the chance of any external wiring affecting operation of the mixer.

In other words it is a unit, into which the aerial feeder connects at one end, and from which the IF signals proceed at the other.

It is merely bolted into the main chassis, supplied with input, output and power leads and coupled mechanically to the station selector knobs at the front of the set.

Once having been developed by a set manufacturer, and proved to be satisfactory, a tuning unit of this type may be incorporated in many models over many years. It may appear in mantel receivers or deluxe consoles, varying a good deal in all respects, other than the tuning mechanism.

In fact, it is not unusual to find branded receivers using tuning units —"front ends"—fabricated by some other manufacturer who may specialise in such devices.

In a subsequent article, therefore, we propose to examine the circuit and physical arrangement of typical "front end" units, of the type which will be seen in locally-made receivers.

by Neville Williams

Before doing this, however, a good deal of basic groundwork has to be covered, relevant to methods of tuning, choice of valves, circuit arrangements and such like.

To start right at the beginning, the aerial connection to a television receiver is much more significant than it is for a conventional broadcast receiver.

As we have already seen, the aerial itself must be carefully designed to operate as a partially resonant device—in fact as a truly resonant one, wherever it can be managed. Its impedance at the point where the feedline connects must be predictable and as near to constant as possible. The fee itself must have a characteristi pedance which matches that o aerial.

These provisions are necessar in the interests of signal stre (2) to preserve a symme directivity pattern and (3) to vent the generation of reflectio the aerial system, which might rise to "ghost" images.

The aerial input circuit of th ceiver must be designed, in tu provide a suitable terminating pedance for the receiver end o feedline.

LOCAL PRACTICE

It would appear that Aust practice will be to use aerials operate in conjunction with bal feedlines, having an impedan between 200 and 300 ohms.

On this assumption, we can e Australian receivers to be fitt a matter of course, with two terminals, connecting to the re ive ends of a centre-tapped primary winding.

The centre-tap normally co to chassis and thence to earth viding an escape path for stat charges and also some pro from electrical interference c capacitively to the aerial syst

All this is in line with Am practice, where balanced fee appear to be favored. In Engla the other hand, it is more cu ary to use coaxial cable betwe aerial and the receiver. In s case, the feedline connects to t ceiver through a coaxial thence to one end of the primary winding. The other the winding is earthed.

PRIMARY TURNS

In either case, balanced balanced, the number of tu the primary winding determi nominal primary circuit imp

It is also common practice clude "trap" circuits in the i input system, tuned to the st intermediate frequency for ceivers. Such traps minimise tion of the receiver's own IF and also give some protection interference from external so the IF.

Because the signal frequen cuits must have a wide b characteristic, they cannot signed with a high "Q" facto ability to reject off-frequency therefore leaves much to be and interference can so penetrate to the IF amplifie ticularly when the signal fr circuits are tuned to one lower frequency channels.

AUSTRALIAN TELEVISION CHANNELS

Channel 1	49-56Mc.
Channel 2	63-70Mc.
Channel 3	85-92Mc.
(For use in inland country areas only)	
Channel 4	132-139Mc.
(Available from July 1st, 1963)	
Channel 5	139-146Mc.
Available from July 1st, 1963)	
Channel 6	174-181Mc.
Channel 7	181-188Mc.
Channel 8	188-195Mc.
Channel 9	195-202Mc.
Channel 10	209-216Mc.

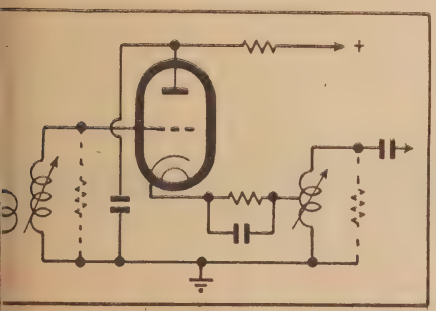
UHF Channels are provisional only, 50 channels being envisaged between. 500 and 855Mc., each 7 Mc. wide.

ng in a modern, multi-chan-
evision receiver is seldom ac-
shed by means of a ganged
or — and for reasons which
rly obvious.

ake tuning and oscillator cir-
esonant at frequencies above
only very small values of
ance and inductance are nec-

ctual fact, the amount of
ance one might nominate for
pose could easily be less than
evitable "stray" capacitance
valves and wiring.
, the requisite coil might be
ll and have so few turns, that
ount of wire involved — and
ctance — might be little more
hat of the necessary inter-
ing leads.

ther words, the tuner must
very close to that portion of
requency spectrum where
ors and inductors as such must
ace to resonant lines or other
f tuned circuit "plumbing".
ntroduce into the circuit the
m "C" of a ganged tuning
r and then to expect it to
ch tiny inductors all the way
50 Mc is clearly an imprac-
pproach.
e variable ganged capacitors
een used, they have been
ed with tapped inductors.
o, great ingenuity has been
d to keep the minimum "C"
ough to give the required



and bandpass characteris-

general rule, the reverse
e is adopted. The capacit-
kept as low as possible and,
s the signal frequency cir-
concerned, it is usually the
t by "strays".
ppropriate amount of induct-
then introduced to produce
e at the required frequency.
es the inductance is made
usly variable; sometimes
of a coil are switched into
ometimes a turret arrange-
used to introduce complete
e for each channel, each
ed by means of an adjust-
.

almost without saying that,
ve of the method used, low
apacitance and extremely
ds are essential. It is not
natter of circuit efficiency.
n "stray" capacitance and/or
e simply make it impos-
tune the highest channels.
hall have more to say in
article about the physical
which practical tuners take.)

However, by keeping capacitance to a minimum and varying inductance, the L/C ratio is sustained. Since the circuit is loaded by the input impedance of the associated valve (a point we shall explain later), the net result is a circuit which supplies reasonable signal excitation to the following grid, while having an adequate broadband characteristic.

It must, in fact, be substantially flat in its response over the 7 Mc bandwidth of any given channel.

Figure 61: A triode, cathode-follower type RF stage, which has low noise but also low gain. The resistors shown dotted across the coils are necessary if their natural selectivity is too high for the required bandpass characteristic.

The oscillator circuit is normally arranged to operate at a higher frequency than the incoming signal and usually has a lower L/C ratio in

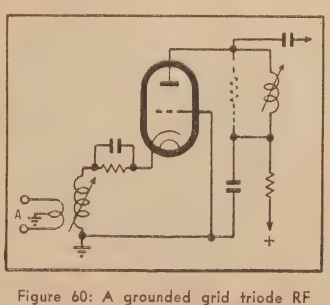


Figure 60: A grounded grid triode RF stage. Main difficulty with the circuit is its very low input impedance. Cheap VHF tuners have been made with a 300-ohm ribbon feeding directly to the cathode circuit, without any provision whatever for input tuning.

the interests of stability. The extra capacitance is often supplied by a small variable capacitor, which also acts as a vernier adjustment on the oscillator frequency.

Thus the switch or turret may be rotated to the appropriate channel position for "Coarse Tuning", the oscillator vernier serving as a "Fine Tuning" control. Concentric knobs

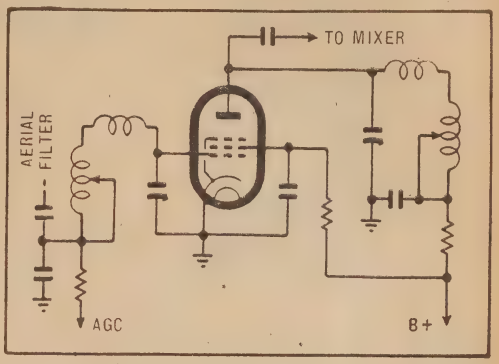


Figure 59: The essential features of a 6AK5 pentode RF amplifier stage, extracted from an early American television receiver. Pentodes have largely been superseded in the first stage because of their inherently higher noise characteristic.

are often used for these two functions.

As already stated, television receivers normally use some form of RF stage:

(a) in the interests of gain;

(b) in the interests of signal-noise and image ratio;

(c) to isolate the oscillator from aerial loading effects, and

(d) to help prevent oscillator energy from being radiated into space from the aerial.

This latter point is a very important one, because it takes very little stray coupling to allow quite a large oscillator signal to be radiated from a resonant TV aerial. In fact, in the US, before the problem was fully appreciated, it was not uncommon to find receivers radiating up to one hundred times as much oscillator power as they needed signal input for satisfactory operation.

CHAOTIC CONDITIONS

This created chaotic conditions in apartment houses, where large numbers of receivers were operating in close proximity, all tuned to different programs, using different intermediate frequencies and radiating varying amounts of energy into space.

Nowadays, standards for receiver design lay down recommended intermediate frequencies, maximum permissible oscillator leakage and methods for testing for same.

The choice of valve and circuitry for an RF stage raises a number of questions which are not particularly urgent in a receiver operating at lower signal frequencies.

One of these — the matter of capacitance—has already been mentioned. A few pf., which would not be significant in a broadcast set, may make all the difference when shunted across a circuit resonating at over 200 Mc.

The same remarks apply to valves used in the mixer and oscillator

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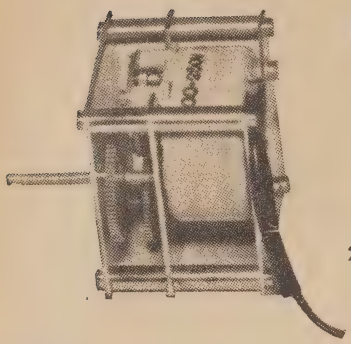

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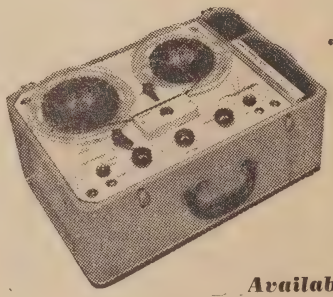

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which also have to operate rable frequencies.

things being equal, the l be preferred which shows t figures of input and out- itance. This may stem from and the arrangement of the nd from the size and of the internal leads and s.

r important point is the in- tance, which appears as a oad between the grid and

s due partly to electron ne effects within the valve nly to inductance in the eturn circuit. This latter n to plate, grid and per- en circuits and the feed- ct which results tends to egenerative loading back grid circuit.

PEDANCE

esult, a valve which may have an almost infinite istance impedance on the band may show an appar- nce of only a few thousand few hundred ohms in the 50-200 Mc.

esigners try to counter the using miniature electrodes, nal leads and two or more ads, so that input and out- n circuits can at least be solated.

as a television receiver is a certain amount of in- g can be tolerated but cer- more than is required to "Q" of the input circuit sufficient degree of broad- y loading over and above only mean loss of input deterioration of an already ection characteristic for ignals.

ere is the question of valve general, this is not very the broadcast band, be- ospheric and circuit noise the first grid is high swamp out noise which equently be introduced by itself. By and large, one lesigned RF stage is as nother.

BAND

VHF band, however, and y up around 200 Mc, the tribution from the input uite small and valve noise important in relation Thus, in areas where the elatively weak, the differ- en a "noisy" RF stage and RF stage is quite signifi-

appears in a television a coarse, moving grainy n is best described by the m "snow".

valves intended to oper- h signal frequencies are igned with high values of ctance. While this in- difficulties of manufac- multiplies capacitance ensures better gain in service and also more eration where the valve an oscillator.

ering an RF stage, the lination is to assume a mplifier, as in normal and shortwave receivers. overseas TV sets did, in entodes of the miniature high-slope variety, such as the 6AK5.

Figure 59 shows portion of a typical pentode RF stage, extracted from an early American model receiver. It so happens that it uses gang-tuned plate and grid circuits, with tapped inductors, again typical of early American practice.

However, experience has shown that pentode valves are not the best choice in a multi-channel television receiver, even where selected types are used.

Not only is the input resistance inconveniently low but the valve noise is high. Most of this is due to so-called "partition effect", the erratic division of current between plate and screen circuits.

In the interests of low noise, a triode has much to recommend it. However, triode RF amplifiers are not at all satisfactory where plate and grid circuits have to be tuned to similar frequencies, because feedback through grid-plate capacitance produces instability.

It is, in fact, the very effect which brought about the famous "Neutrodyne" circuit in the early days of broadcast receivers.

While neutralising could still be used, it is far too critical a method to have to rely on as the only precaution against instability in a multi-channel VHF tuner. Accordingly, simple grounded-cathode triode RF amplifiers are never used.

The problem of instability can be solved, however, by changing the configuration of the circuit. Figure 60 shows a grounded-grid triode RF amplifier.

The input signal is fed to the cathode, the grid being earthed and forming an electrostatic shield between input and output. Difficulty with instability is thereby obviated.

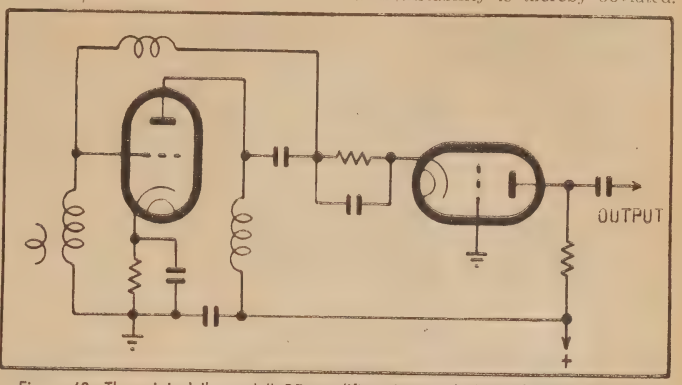

Figure 62: The original "cascode" RF amplifier circuit, which combines the features of high gain with low inherent noise.

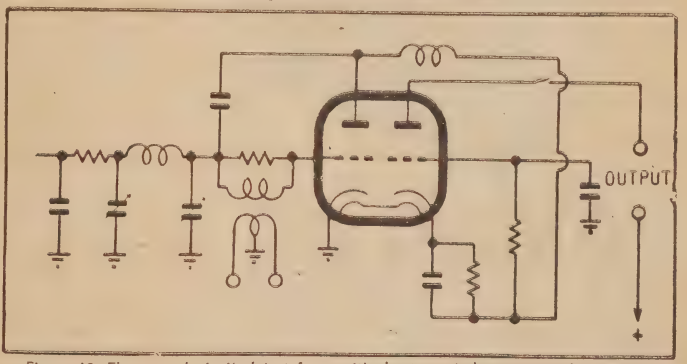

Figure 63: The cascode in its latest form, with the two triodes connected in series as far as DC is concerned. Sometimes the second grid is returned to a divider across the HT supply and the cathode bias components omitted.

Chief difficulty with the circuit lies in the fact that its input impedance is extremely low and any improvement in noise characteristic is offset by loss of signal due to input circuit loading, not to mention the deterioration in image ratio.

Figure 61 shows a cathode follower type RF stage, again using a triode. In this case, the signal is fed to grid, the plate is bypassed to earth and output is taken from the cathode. The circuit is highly degenerative and, while noise level is low, so also is the stage gain.

IMPORTANT POINT

This point is a quite important one because low gain in the RF stage means that the signal has not been much amplified by the time it reaches the frequency changer. The noise characteristic of the frequency changer may therefore become a limiting factor in the receiver's performance.

In general, single triode type RF stages are only used where economy of design is the paramount feature.

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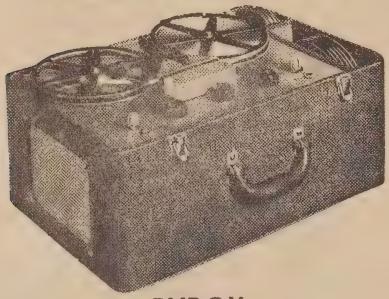

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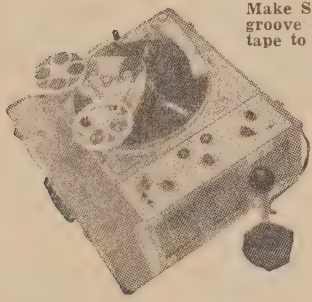

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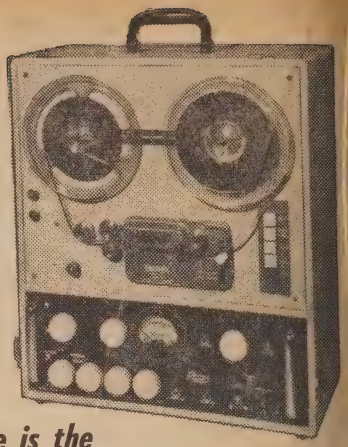

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l to its limit, such an approach roduce a complete one-valve end". One section of a high-ncy twin triode serves as an plifier, the remaining section lf-oscillating mixer.

using both sections of a triode for RF amplification, in very interesting circuit igements have been devised, h give the high gain ex-d from a pentode but with noise factor.

ie such arrangement, the first s used as a cathode follower, he input signal fed to grid h the plate bypassed to earth. thode circuit returns to earth an aperiodic RF choke, lso serves as an earth return cathode of the second triode. grid of this second triode is output being taken from its In other words, the first sec-s a cathode follower, feeds e second as a grounded grid r, the two being coupled by e in the common cathode

ever, by far the most popu-uit is the so-called "cascode" lifier, which was first widely y Amateur Station operators r VHF communication re-Nowadays, it has been adopt-ost universally for television rs.

CASCODE"

e 62 shows the cascode in its form, where its operation ily be followed.

ncoming signal is fed via the erial filter to a tuned grid cir-nce the input impedance can reasonably high, there is no input signal as happens, for e, with a grounded grid stage.

xplained earlier, however, the ed cathode circuit is prone ability and measures are re-to combat it.

ng again at figure 62, it will d that the plate of the first s coupled to the cathode of cond, which operates as a ed grid amplifier. In con-e, the very low input im-of this second stage heavily ne first plate circuit.

e these conditions, the actual ain of the first section is r limited, so that the voltage k capacitively to the grid is maller than would be the th a tuned, unloaded plate The tendency to instability fore much reduced.

TIALISING

simitation is usually sufficient own to ensure stability but orm of neutralising is fre-added, as well, to eliminate ative effects, and generally to a lower inherent noise level e stage. In figure 62, neutral-is provided by a inductor, to have just the right re-but in opposite phase to the te capacitance.

loading on the interstage g circuit, L2, is so heavy that ly tuned circuit is neither l nor necessary. Sometimes g coil is used as shown; at imes a bi-filar wound coil erred, to give separation of potentials and eliminate the r a coupling capacitor.

(ontinued on Page 119)

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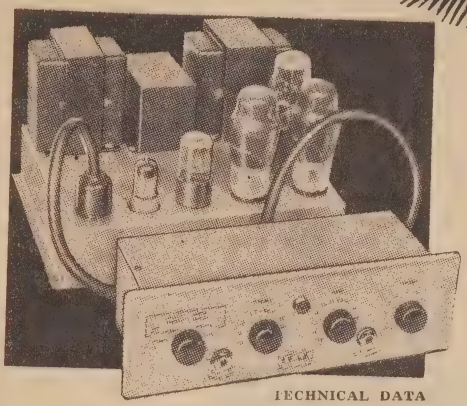

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Frequency Response	+ or —1db, 30c/s to 20 kc/s
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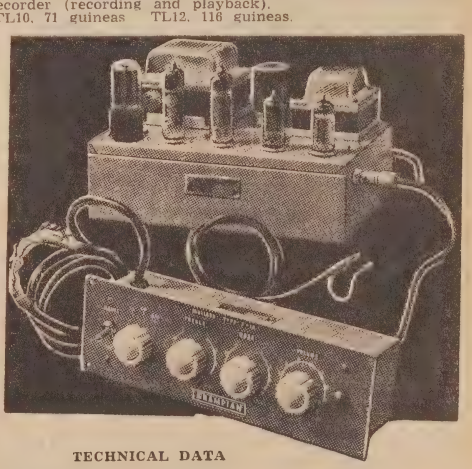

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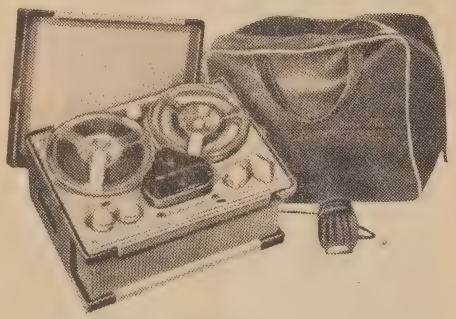

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SINGLE-SIDEBAND TECHNIQUES

The application of modern techniques, the single sideband principle ling increased application in communication systems. This article gineers of the Aerovox Corporation explains the basic principles of SSB transmission and reception.

the days of the earliest -telephone transmissions, gineers and experimenters en impressed with the fact nventional amplitude-modu- nal contains all its neces- lligence in one of its side-

sociated with the transmis- his sideband is an identical l sideband and a carrier nt, so the total transmitted mounts to six times that gle sideband, which con- the necessary intelligence.

THER SPACE

same time, the conventional e-modulated signal takes up much precious frequency bandwidth as a single side-

been found that certain fading, common with am- odulated signals, are either d or greatly reduced in eband transmissions. This larly true of selective fad- n results from propagational riations between carrier and sidebands or between the two sidebands themselves.

Elimination of the heavy and expensive high-level audio-frequency components of the conventional AM transmitter is a powerful argument in favor of the single-sideband system.

Radio transmission with suppressed carrier and a single sideband has been used almost as long as the conventional double-sideband amplitude-modulated type. It was employed for Transatlantic radiotelephony at low frequencies as long ago as the early nineteen-twenties.

Because at that time the direct filter method was the only one generally applied, the inconvenience of heterodyning, instability of oscillator components and other factors limited practical use of such a system to the lower radio frequencies.

In the past few years, development of high-grade components and new techniques of circuitry have made single-sideband-suppressed-carrier (SSSC) communication at higher frequencies more attractive. Improved stability and selectivity in receivers and receiving systems have also been helpful in this development.

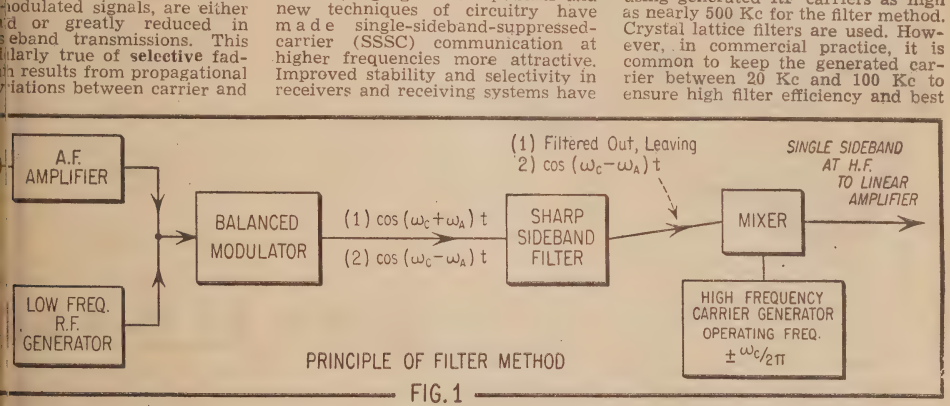
Two main methods of generating single-sideband signals are generally employed: The filter method and the phasing method. The filter method is the older of the two, and in principle is simpler and more direct. This principle is illustrated in Fig. 1.

The carrier is removed from the composite modulated signal by means of a balanced modulator. Then a filter with a sharp frequency characteristic, connected at the output circuit of the balanced modulator, removes the unwanted sideband.

LOW FREQUENCY

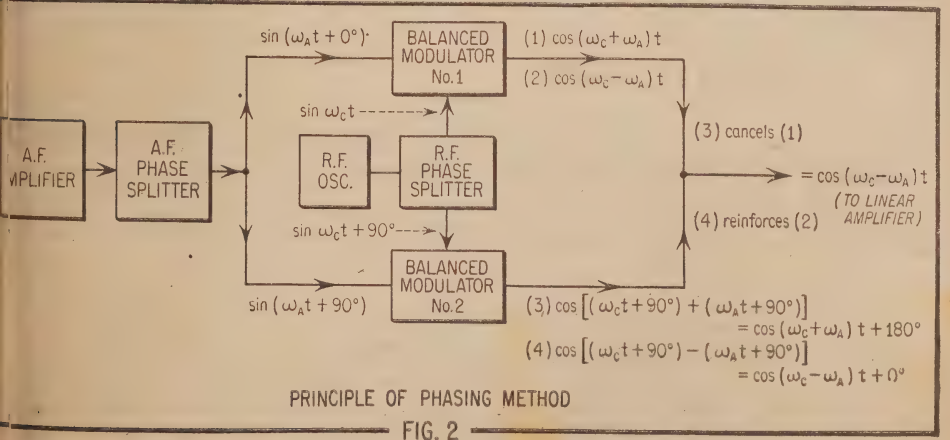
In the filter method, the carrier must be generated at a relatively low radio frequency. If the radio frequency is too high, the percentage frequency spacing between the two sidebands is too small. Filters sharp enough to isolate the desired sideband would introduce too much phase distortion.

Some amateur installations are using generated RF carriers as high as nearly 500 Kc for the filter method. Crystal lattice filters are used. However, in commercial practice, it is common to keep the generated carrier between 20 Kc and 100 Kc to ensure high filter efficiency and best



PRINCIPLE OF FILTER METHOD

FIG. 1



PRINCIPLE OF PHASING METHOD

FIG. 2

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M2

attenuation of the unwanted band.

The single-sideband signa the balanced modulator and is then transposed to the higher operating frequenc heterodyning with higher fre carriers in one or more suc mixers.

If the operating frequency i times that of the carrier of th band generator (as is ordinar case in high-frequency trans of the filter type), more th stage of mixing is necessary.

This is because when the output frequency is very higher than its input frequenc the frequencies of the sum a ference heterodyne product close, it is difficult to attenua unwanted heterodyne.

LIMITATIONS

The necessity for one or mixing stages and lack of fle in switching from one sideb the other are disadvantages filter method as applied to the communications frequencies.

In most cases, the need for stages can be eliminated by the phasing method of singl band generation. In this r the RF carrier can be gener the transmitter's output op frequency. The principle is trated in Fig. 2.

The mathematical expressio the various signals, assum single-tone modulation signa given alongside their res paths.

Both the audio-frequency lating signal and the carri divided, each into two com in quadrature. As shown, phase component of the AF is combined with one phas ponent of the carrier in a ba modulator. In each case, th anced modulator removes the leaving two sidebands in the from each modulator.

In the example given, as the use of a single modulati quency, there would be just a frequency side-component on side of the carrier frequenc no carrier) in each case.

After the balanced mod their outputs are combine phase relations of the four sid (or single-frequency compone such that one sideband is ca while the other is reinforced

ADDS, CANCELS

In the example illustrate carrier component which wa ed 90 degrees is modulated by component which was shif degrees.

As can be seen by the matical expressions, combina such phases results in cance the high frequency sideba reinforcement of the low fr sideband.

The phase of either the AF carrier component can be to provide high frequency s output instead of low fr sideband output.

One of the critical section phasing type transmitter is th phase shifter, which must two AF signals 90 degrees all frequencies in the mo range.

ne normal voice-communica-
equency range, a simple RC
will accomplish this. A
phase shift network for this
is illustrated in Fig. 3.
of the problems connected
h a circuit, of course, is the
ues required for most of the
nts. Special, non-standard
nts would have to be

ver, a big step forward in
the phasing type of trans-
nore practical was the pro-
y several manufacturers of
phase-shifting networks in
npact form.
of these standard commer-
ailable networks is com-
enclosed in a metal tube
, of the same size as a 6J5
d plugs into an octal socket
& Williamson Model 350).
des a 90-degree phase shift
to within plus or minus 1.5
over an audio frequency
300 to 3000 cps. adequate
communication purposes.

AMPLIFIERS

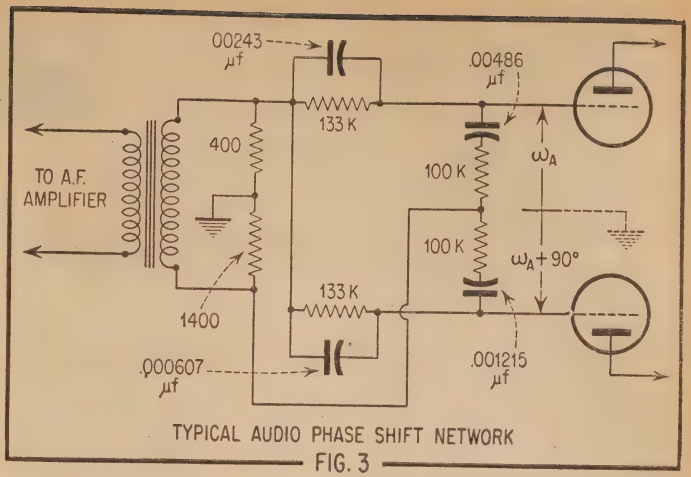
f SSSC communication has
renewed attention to linear
design. Two factors are
nt in these amplifiers: (1)
ortion, and (2) maximum
un. Stability, which is very
t, is interrelated with dis-
so is not classified separ-

tion of the full advantages
mited bandwidth of single-
transmission requires that
be well controlled.
especially true in services
each sideband is used for
ion of different intelligence,
case distortion manifests
splatter and noise effects
channels. Thus, low dis-
an be considered even more
t in SSB linear amplifiers
the conventional carrier

e other hand, high power
lso an important considera-
ingle-sideband generators
operated at relatively low
hus, if linear amplifiers
llow do not have a high
in, a large number of stages
used, and this is uneco-
nd leads to unreasonable
nce and adjustment require-

RADICTORY

ordinary conditions, very
rtion and high power gain
ompatible. High power gain
obtained with best linear-
lowest distortion. It is the
tion of these two factors
the objective of most mod-
r amplifier development.
nventional grounded-cath-
r amplifier exemplifies the
er-gain type, especially
uits employing tetrodes and
es. However, in the latter,
power gain is not consist-
minimum distortion.
he screen voltage is raised
enough level to minimise
e requirements, the static
rent becomes so high that
dissipation is likely to be-
essive.
other hand, when the static
rent is kept low, distortion
uced. One way to maintain
rid drive requirement and
static current limited is
gative feedback.
opular way to introduce



TYPICAL AUDIO PHASE SHIFT NETWORK
FIG. 3

feed-back to improve linearity and stability is to use the grounded-grid circuit. Although this does provide excellent linearity, the power gain is low.

A somewhat different arrangement for obtaining high power gain with low distortion has recently been suggested. ("Linear Power Amplifier for SSB Transmitters" by W. B. Bruene, Electronics, August, 1955, P.124).

2-STAGE FEEDBACK

In this arrangement, feed-back around both stages is introduced. The first stage is operated class AB1 and the second either AB1 or AB2. A power gain of 5000 with distortion reduction of up to 16db over conventional circuits is claimed.

Even though tetrodes are used, neutralisation is provided; this is desirable to minimise single-stage instabilites. Less circuit "swamping" is then required.

The most efficient method of reception of SSB signals is the **phasing** arrangement, which is the reverse of the transmission method illustrated in Fig. 2.

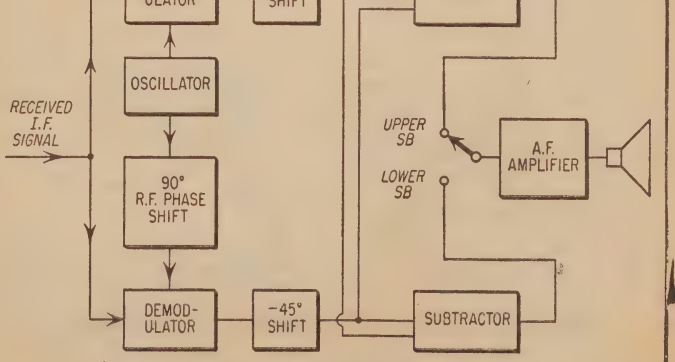
A block diagram of the front end of the phasing type receiver is shown in Fig. 4. In applications in which a "pilot" carrier level is transmitted, automatic frequency control is employed in connection with the local oscillator. Otherwise a suitable vernier adjustment of oscillator frequency must be available to facilitate manual control.

General improvement in component and material quality have contributed greatly in bringing SSB, receivers to a relatively high state of development. The narrow pass band (usually about 3Kc) and steep skirt selectivity desirable in this service can now be provided by crystal lattice filters or by the new mechanical IF filters.

MANY ADVANTAGES

These go a long way toward full realisation of the full advantages of the single-sideband system, which include improved signal-to-noise ratio, interference-rejection, and the fuller use of valuable frequency spectrum. These are in addition to the propagational and economic advantages previously mentioned.

In conclusion it may be said that present trends certainly indicate that before many years most communication services will have converted to single-sideband operation.



BLOCK DIAGRAM OF PHASING-TYPE SSB RECEIVER
FIG. 4

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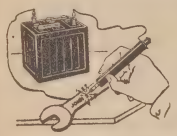

29/6

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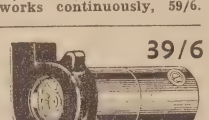

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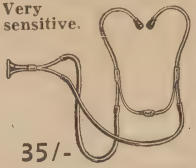

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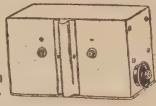

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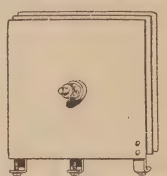

Transformers to suit above, 2 amps, 39/6; 6 volt, 5 amps, 45/-; 12 volt, 5 amps, 55/-. Transformer to suit dual charger, 6 and 12 volt, 39/6. Rectifier to suit, 45/-. Circuit supplied.

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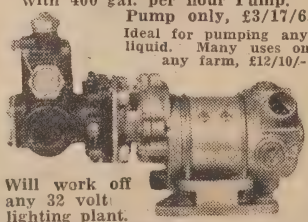
Ideal for pumping any liquid. Many uses on any farm, £12/10/-



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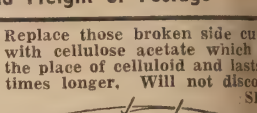

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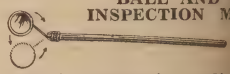

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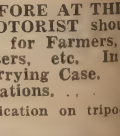

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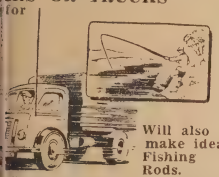

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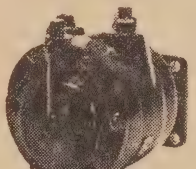

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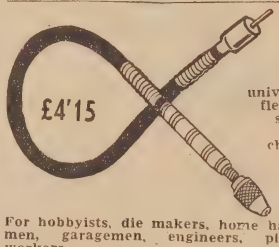

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OFF THE RECORD — NEWS & REVIEW

To most of us, the names of various concert halls which appear on record labels are just na while the artists and orchestras who play in them are known only by their recorded musi is an enriching — and enlightening — experience to go into some of these places and the performance at first hand.

by John Moyle

UNFORTUNATELY, one has only time to register reactions in passing, never to write them down in any detail.

At the end of a day, one must catch up on sleep. Then tomorrow comes, and it's full again with places you must visit, people you must see and still more things to jot down in the diary.

However, all these experiences will provide valuable background when I return to Australia, things to remember and write about; visits to the famous Festival Hall, to famous recording studios and so on in an almost endless array.

I had hoped to be able to review a few records over here, to reinforce the batch which I did before leaving. It was a forlorn hope, even more than I realised at the time. There are records, all right, hundreds of them, but no time to spend the hours necessary to listen and to do them justice.

Don't be dismayed then, if the reviews disappear for a couple of months, to be replaced by other material. It will only be a temporary arrangement and I'm looking forward to relaxing with the old set-up and a pile of records, just as soon as I possibly can.

MOZART — Operatic Arias sung by Elisabeth Schwarzkopf with the Philharmonia Orchestra conducted by John Pritchard. Columbia 330CX1069.

Anyone who sings as charmingly as Elisabeth Schwarzkopf in this record doesn't deserve to be picked at, and I don't propose to do it.

She is a singer in the Lehmann-Schumann line, although, for all her sweet sounds, I would hes say that she has yet achie vocal consistency and cor either.

There are times when s little uncertain, others wh jumps into a note which sh entered more smoothly, othe when she produces an odd s easy to describe.

But these are small laps what would otherwise be perfection.

All the time we have pro vitality, youthfulness and ness which, mixed together to the type of personalit met with on stage or disc.

I think, too, we can skip th ard question about whether are or are not good things These are many of Mozar liest arias, mostly from Fig he would be a dull man w not sit through them, at lea at a time, with joy.

The recording, as with EMI discs of late, is rea The orchestra plays as thou enjoying its job (and who be?), and its contribution i and sympathetic.

There is no surface noise the RIAA curve shows its

FRANCK — Sonata major; SZYMANOWSKI ata in D minor Opus 9 by David Oistrakh and V Jampolskij. Columbi OCX1201.

This is a warm, almost ate performance of the Fra ata, masculine in its fla the broad flowing phrase fully produced and shape

Frankly (no pun intende it better than any of Oistr cordings to date. No men vations at all suggested th as they have, to me at lea past.

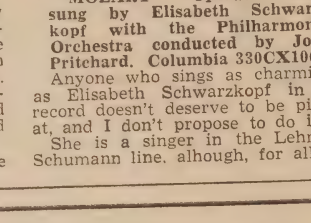
Here I think you will violinist's fine, consistent superb bowing to its very vantage.

When balanced against h I did not have the usual that Oistrakh had been s by the mixing panel to ment of his accompanis polsgij (what a name!) is be self effacing, but I have rel with his contribution.

The Szymanowski sona well known as the Franck will probably recognise at of it—tuneful, romantic pleasant to hear but with lasting quality.

The recording is first ra is no surface noise, and sound really well on a ment. I don't think you any further for a preferr ing of the Franck. The as good a companion as

NEW TAPE CIRCUITS



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HUBERT—Quartet No. 15 major Opus 161. Played ie Budapest String Quar- Philips AO1172L.

was Schubert's last Quar- despite the fact that it much more maturity and stature than most of the chamber works, it was writ- in 10 days.

der how many modern com- could resolve their musical hnical problems as such a

imagine, because Schubert inning to emerge from the ere most of his works were n various guides, that this has lost the composer's stamp.

sn't as immediately appeal- re is no doubt that it im- with its surer sense of de- nt and rhythm, and a fore- a future which Schubert's ath cut short.

ere is melody, too, and those rases which flow through music like flashes of light r, to haunt one's mind long music is done.

cording is one of the Lib- ongress series for which the tradivari set of instruments d. Once again you will be with the balance and re- osphere which make these s among the best string know.

cularly liked the work of st, and the way in which anced against the rest.

particularly how effective n the last movement, in- the very last bars, where pizzicato is so perfectly d weighted.

s a work worth knowing, erformance unlikely to be d.

urface is perfect — not a m it. Technically, if not full wide range class, a s disc.

ZOUNOV — Violin Con- n A Minor Opus 82. NINI — Violin Concerto in E flat major Opus 6. by Michael Rabin and hilharmonic Orchestra ed by Lovro von Mata- lumbia 330CX1281.

uneful examples of the assics in an appropriate ace.

in characteristic of Rabin ist is his warm, lush tone strokes strongly and with

ore successfully exploited zounov than in the Paga- e former is an attractive ntic work, in which the ys almost continually from nish. It is not very de- technically, but demands cope with its many melo- sures.

ganini on the other hand int show-piece, and would more successful with a ot to say more flashing

is the concerto doesn't ite as brightly as it could, bin's undoubted dexterity, ore genial air as opposed 's edge. His intonation, y an extremely forward is a little below the top not much. But his fresh a joy to hear and out- ser criticisms.

The orchestra in both pieces plays a minor role in comparison to the solo part. It is hard to estimate therefore, that it's playing is any more than adequate.

More impressive to the listener is the dead quiet surface. Not a click or a switch from beginning to end.

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This disc is mostly a personal triumph for Denis Brain.

Not often does a horn player get a chance to star in his own right, for the horn hasn't the interest range of the standard solo instruments.

And in any case, good horn players aren't easy to find. It is a most difficult instrument to play, and there is not much point in trying unless you belong to an orchestra.

Musically the concertos are pleasant enough, but long passages are so conventionally Mozart that they might have been extracted from other works, given a little "treatment" and re-issued.

Nor is the horn sufficiently interesting in itself to support a full sized work.

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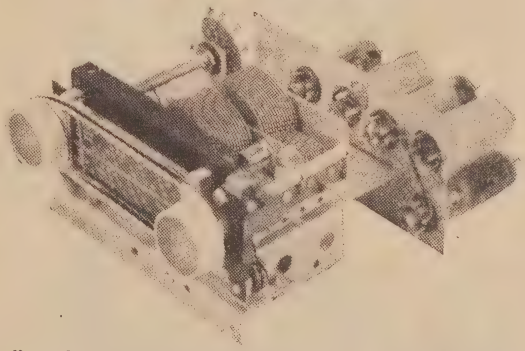
TUNERS



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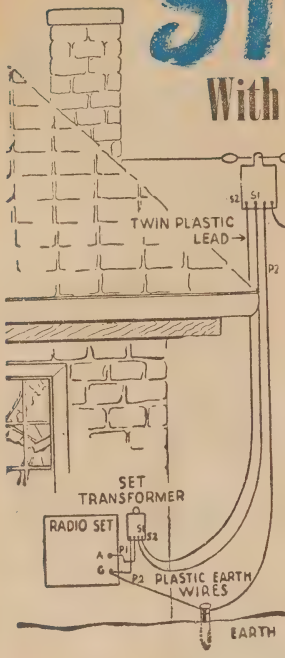

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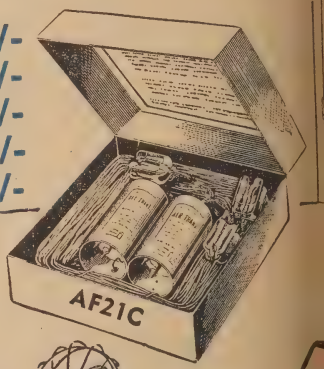

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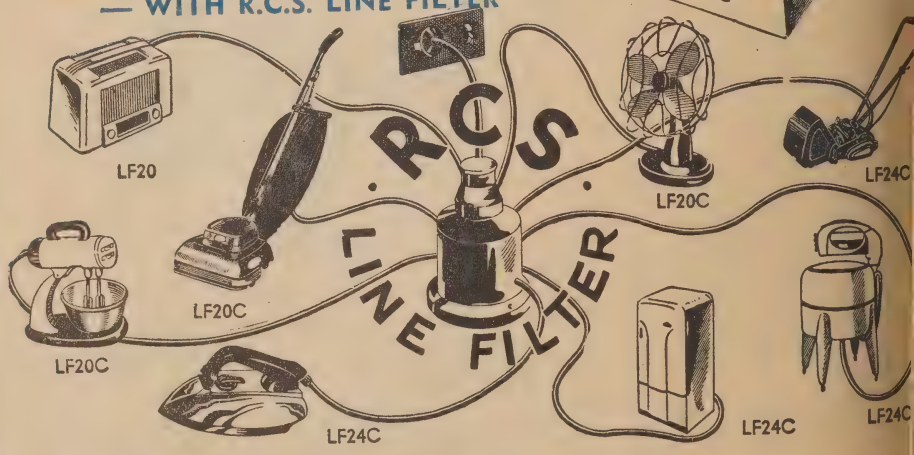

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of the four concertos were
or a friend of Mozart who
to be a horn player, as
en the case with composi-
ich feature unusual com-
The origin of the fourth
obscure, but it could have
of the set.

Brain plays impeccably.
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work, particularly in the
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ll. His tone sounds always
round, and he produces it
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hestra cannot disguise its
ut plays with admirable
and at no time makes diffi-
the soloist.
sual record, but pleasant
ssful.

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leluia. Played by the
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conducted by Frederick
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as a piece of recording,
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place with the best Mer-
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Prelude and Aztec Dance
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gh with cymbals and
brass, all encompassed
uge dynamic range and
p of surface noise.

—here is a show piece
ence. Use the RIAA.

TAKOVITCH — Sym-
o. 10 in E minor Opus
yed by the New York
nonic Orchestra con-
by Dmitri Mitropoulos.
ABL3052.

This last composition of the controversial Russian is one about which you will have to make up your own minds.

It is not a work for the average melody-music listener, who will find in it little to attract him, and a long road to travel before he finds much which will reward.

It has been suggested that the composer's attempts to improve his counterpoint are responsible for the huge, sprawling, and indigestible first movement. It is undoubtedly quite unlike the more open style we have been used to, but which returns in some degree with the opening of the second movement.

I wonder if it is significant that two of Erope's leading conductors are reputed to have produced widely differing interpretations in their first performances? No doubt Mitropoulos has yet another version—I don't know.

There is undeniable weight in the work, and it sounds as though the composer intended it to be a highlight, although his expressed confession of failure in what he set out to do in the first movement, and the fact that it was "written in a hurry", won't do much to fix it very firmly in anyone's mind.

At any rate, judgment should not be hasty.

Be that as it may, Philips at least have done their part in handling the sound most competently. Like the playing itself, it is firm, round, and well-defined, plenty of weight when called for and adequate mass coupled with clarity.

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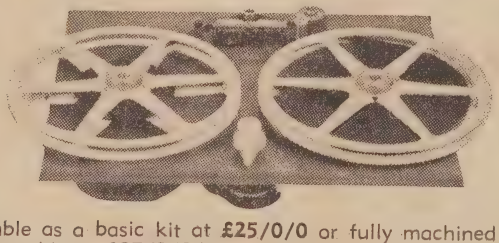

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SHORT-WAVE NOTES BY ART CUSHE

WINDWARD IS.—LATEST NEW COUNTRY

Windward Island Broadcasting Service at Grenada is the latest new station, others in Philippines, Dutch New Guinea, and Netherlands are also mentioned.

THE new Windward Island Broadcasting Service, broadcasting from St. George in Grenada, has been heard in both Australia and New Zealand on this 16 metre band frequency. The station signs on at 7.55 am with a series of piano notes as interval signal, and this is followed by a programme summary of the evening's broadcasts.

BBC news relays are taken at 9 am and noon and the station leaves the air at 12.15 pm. Signls are fair when the station first opens but fades out after 30 minutes.

In South Australia Rex Gillett is enjoying longer reception, and reports the signal very good for the low power of 250 watts which is scheduled to be used by the West Indian station. The station gives the sign off time at 10.15 pm in Grenada, which is the same as 12.15 pm the following day in Sydney.

The Windward Island station first came into the DX field some months ago during a visit by Princess Margaret. But at this time was using the 3 megacycle band, which did not favor reception in this area. The use of 16 metres does suit the circuit conditions as, at this hour, the BBC are also serving the West Indies and Australasia on this path across Central America.

VOICE OF CIVIL DEFENCE

THE National Civil Defence Administration of the Philippines has verified our reception with the news that they operate two transmitters, NCDA-1 in Manila on 3305 Kc and NCDA-2 in Iloilo City on 3365 Kc. Last month we reported the reception of NCDA-2 and later heard the Manila transmitter.

NCDA-1 in Manila uses 3305 Kc and is on the air 7.00-10.00 pm, except Sunday. The program in NCDA is at present 7.00-8.00 pm dedication program and popular music announced in English, 8.00-9.00 pm program in local dialect including news and important items of interest, 9.00-10.00 pm news, sports and editorials including Civil Defence news broadcast in English.

A further transmission is made on 5970 Kc reports Gordon Watson, Waipara, NZ, and this is aired 11.00 am-noon. In our letter from Alfredo G. Eugenio, Civil Defence Adivsor, the address of the station is given as Office of the President, National Civil Defence Administration, Independence Grandstand, Luneta, Manila.

NCDA-2 at Iloilo City broadcast the Civil Defence Network from 7.00 to 10.00 pm daily, and then appears to take the program of DYRI to sign off at midnight.

Reports on the reception of the station are very welcome at NCDA and are confirmed in a letter by airmail, in which a request is made for future letters reporting the signals in this area.

RADIO SORONG

REPORTED last issue on 3395 Kc, a new Dutch speaking station, which we presumed was in that area, has been identified as Radio Sorong, Sorong, Dutch New Guinea. This information was kindly supplied to us by the Post Master General at Hollandia, to whom our report was addressed.

Radio Sorong is a privately owned station using 3395 Kc and broadcasting with the power of 500 watts. The transmission Monday to Thursday 7.30-10.00 pm, Tuesday and Friday 7.00-10.00 pm, Sunday 7.30 -10.00 pm, and 11.00 am-1.30 pm. The only other station in operation in the area is the Biak station on 5045 Kc which now operates 7.00-1.30 pm.

Mr. J. J. Spruit, Postmaster General at Hollandia, advised that my report had been sent to Radio Sorong and we hope soon to have further details about this station on 3395 Kc.

NEW CHANNELS FOR JAPAN

TWO new channels came into operation in May when Radio Japan commenced the winter schedule. These two frequencies are JOA20 on 17825 and JOA21 17845 Kc. These new outlets are used in several transmissions, but the Australian service 6.00-7.00 pm is unchanged on JOA9 17785 and JOB5 15235. The new frequencies are used as follows:—1.30-2.30 pm on JOA20 17825, JOB5 15235 to USA West Coast. 9.00-9.30 am on JOA21 17845, JOB5 15235, West Coast USA. 10.30-11.00 am on JOA21 17845, JOB5 15235, East USA. 4.45-5.45 on JOA20 17825, JOB5 15235, to Europe.

Radio Japan is particularly interested to know the efficiency of the two new frequencies and will welcome reports. Program content will also have some

> Notes for next issue should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are Eastern Australian.

changes on the new schedule and the introduction of programs in Russian brings the number of languages transmitted to 16.

NETHERLANDS — 5 X-MITTERS

THE introduction of the new high-powered transmitters of Radio Netherlands at Hilversum on May 1, gives the station the use of five frequencies in each transmission. Some changes in the schedule to this area means that Australia and New Zealand will be best served this winter in the afternoon transmission.

Mr. E. Van Eldik of the Engineering Service of Radio Netherlands sends the new schedule, and we are setting out below the transmissions which should be best heard in this area.

7.00-7.45 pm weekdays, in Dutch, to NZ and Australia, 17775, 15425, 15220, 9745, 6025.

7.45-8.25 pm in English, to NZ, Australia, 17775, 15425, 15220, 9745, 6025. 8.30-9.55 pm Dutch, New Guinea, Indonesia, 17775, 15425, 15220, 9745, 6025. 8.30-9.58 pm Sundays, English, 17775, 15425, 15220, 11950, 6025.

12.30-1.10 pm English to USA. 11730, 9590.

12.30-2.00 pm Monday, English, 11730, 9590.

Netherlands uses these frequencies, 17775, 15425, 15220, 11950, 17130, 9745, 9590, 6025 Kc.

MAKASSAR ON 4770 KC.

Radio Makassar in the Celebes has been heard on 4770 Kc a channel which is not listed in the 1956 World Radio Handbook, and this appears to be a move by one of the three transmitters in that city, YDQ (3325), YDQ2 (9550), YDQ3 (7295). Reports on the reception of any of the transmitters of Radio Republic Indonesia should be sent to the QSL Manager, Radio Republic Indonesia, PO Box 7, Djakarta, Indonesia.

FLASHES FROM EVERYWHERE

TANGIER transmitter IBRA casting missionary programs to has moved to a new frequency Kc and is well received here to at 6.20 am. Sweden Calling DXe the schedule as, weekdays 3.00-6 Sundays 11.30 pm-2.30 am and am on Monday. Daily broadcasts carried on 9782 Kc 6.30-7.45 am. 10,000 watt are now used on frequency, the two transmitters synchronised. The mailing addr reports to IBRA is Box 822, Stock Sweden.

LATIN AMERICAN news HRNQ Radio Morazan, Tegucigal 6090 Kc. has been heard after the same channel signs off at 1.00 nounces "HRNQ" for both broade shortwave calls. HRXW Radio, guela has shifted from 6110 to

HRYW is now on 6185 Kc fr Radio Difusora Reinade Colombia, is heard on 4755 from 10.00 am pm. HJTC Radiofusora Militar de bia, Bogota, is logged on 6155 Kc off at 2.00 pm, relays HJTA 800 K

GOLD COAST'S ZOY at Accra, Kc is now closing at 8.00 am English transmission from 4.00 a news in relayed 4.00-4.15 am.

CANADA'S transmission to th Pacific has undergone a frequency and CHOL 11720 Kc. now replace 5970 Kc. the other transmitter 9630 Kc is unchanged. The tran time is 6.30-7.15 pm daily. with letters answered in a session at on Sunday.

JAMMING on the BBC Europea missions in Russian showed a ma duction during the visit to Britai Russian leaders. The jamming noted to be reduced at least 50 as we go to press no marked has been shown. The best signa 7.15 am transmission is GRV which has been so far free from a ference. The drop in jamm affects BBC Russian language br and the transmissions to that a Voice of America, Radio Free Eu Radio Liberation are still being interfered with.

NORTH AMERICAN transmissi Prague and Madrid have been new frequencies. The Prague tra at 3.00 pm is now broadcast on channel of 11720 Kc or on the a 25.59 metres. This frequency of is not assigned to Prague so that callsign is allocated. The tra in English 3.00-3.30 pm is also on 9670 and 9550 Kc. Madrid is strong signals in this area in th to North America at 3.15 pm. quency of 6130 Kc is used as w usual 9365 Kc outlet. The are actually released for 45 m 1.15, 2.15 and 3.15 pm, the latt mission being best received.

SOLOMONS VQO2 in Honore has been very well received in Pacific, on confirming the rec this 100 watt transmission. state interference from Radio Free E a nearby channel, is not very their primary area, but they expect that in distant reception not be combated.

Transmissions on 5060 Kc are cept Sunday, 5.00-6.00 pm excep day, when broadcasts commen pm. Sign off is not regularly at, times sign off is as late as 6.

BRAZZAVILLE uses 9730 K as 11970 Kc in the transmissio pm to Europe, North Africa East. News in English is pr 3.15 pm, 4.00-5.20 pm on 9 Central Africa. 8.00-10.20 pm Near East and Europe. 4.00-7 9730 and 11970 Kc to Europe, with English news at 4.15 and

E HAM BANDS WITH BILL MOORE

tions covering the operation of amateur radio stations vary greatly in the different es of the world. Although some amateurs overseas enjoy greater power privileges, enerally Australian amateurs are allowed to operate with a minimum of restrictions.

nateurs do not appreciate the ative freedom from regulations here; whether they be framed ensing or other authorities. he position varies greatly in untries. In the US municipal endeavored at times to exnce fee from amateur operathese efforts were quickly

such authorities require the a building permit before an st or tower can be erected; fee must also be paid.
al of television in Australia ntly bring about the enforcerrent municipal regulations.
ne municipal body in Sydney sed warnings that TV aerials es within the meaning of the rnment Act. This act gives authority to veto objectional

tated that intending viewers to send to councils a formal approval for an outside TV to supply a sketch of the ial to be used.
property tax is also applicnateur radio installations in is levied by many municipal

yns only tax at real estate the case here in Australia, ne station does not receive ntion.

IN THE US

of the extent of local regulang phases of amateur activity eaned from the regulations zetted covering the erection or beams in New York City. plication may be filed by the ur. The applicant shall file lan, the manufacturer, speci- the tower and its support, the er's analysis of the stresses r and its supports, the details guys, braces.
the tower is erected by a consent of the owner shall owers shall not overlap adperty unless the consent of f such property is filed. Guys ened to anchors on adjoining the consent of the owner is

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h shall not be less than one- thickness when used struc- ere towers are constructed of minimum wall thickness of all not be less than one-sixhand such tubing if steel shall d on the exterior.
owers may be accepted in as they are not substantial ffect light or air. They may in residential districts as the dwelling.
constructed of wood may ed on roofs.
he regulations as listed en- owers erected are to a re- ard. Practically all towers the US are commercially ti.

Three times as many amateurs per 10,000 of population are licensed in the US compared with Australia, so towers often break the skyline.

> Notes on amateur radio from interstate sources would be appreciated for inclusion in these columns. Any activity requiring publicity will be duly covered.
> From time to time comment on the NSW trend of these notes has been recorded and without first-hand news from outside the State it cannot be otherwise.
> News should be forwarded c/- The Editor, Radio, Television & Hobbies, or direct to W. M. Moore, VK2HZ, Dobijowi, Pitt St., Springwood, to arrive not later than the third of the month for inclusion in the following issue.

THE annual meeting of the NSW Division was held in April when 80 members attended. No election of officers was necessary as nominations for the council did not exceed seven. The following amateurs will serve on the council for 1956-57:—Jim Corbin, VK2YC; Vince Cahill, VK2VC; Barry Goodman, VK2ZAG; Harry Pickett, VK2AHP; Eddie Hulme, VK2EN; Barry White, VK2AAB.

The president Jim Corbin, VK2YC, presented his annual report covering all phases of institute activity. It had previously been circulated to all members.

Various other officials then reported on section activity. Bob Walters, chairman of co-operative, described activity to date. Chairman of VHF section Roy Hart, VK2HO, reviewed the operation of the section at length and expressed appreciation of the co-operation afforded by the officers of Petersham-Leichhardt Technical College.

Harry Oakes, VK2FA, chairman of the BCI-TVI committee, reported on the progress of the group and Librarian Barry White, VK2AAB, reviewed the use of the service for the year.

Various other institute problems were discussed at length.

The Dural "A home for VK2WI" project sponsored by the NSW Division of the WIA is progressing and late in April the site was cleared by army bulldozers.

Nearly £700 has been raised by donation among members and plans have been drawn up for the building to house the official station.

The location is 16 miles north of Sydney and some five acres in area in a semi-rural district.

When the installation is complete, VK2WI, using the 3.5 and 7 Mc bands and the permissible power of 500 watts, should effectively cover the State under practically all conditions.

The operation of the official station during emergencies is an important function of VK2WI and these duties should be carried out more effectively from Dural.

HUNTER BRANCH

MOBILE operation will be the feature of lectures to be presented at the June meeting of the Hunter Branch of the WIA when Harold Whyte, VK2AHA, Dave Davies, VK2BZ and Bob Cairns, VK2KF, will lecture on portable operation on the 80, 40 and 20 metre bands.

The meeting will be held on Friday, June 8, at the University of Technology, Tighes Hill, Newcastle.

VHF GROUP ACTIVITIES IN N.S.W.

THE operation of the NSW VHF section with the Search and Rescue Division of the Bushwalkers' Association held on April 18 and 19 was extremely successful, despite atrocious weather experienced on the second day.

The main aim was to test the value of fully transportable, light weight, 144 Mc equipment under field conditions in bush searches. Four walking parties entered different areas in the Weeny Creek, Kurrajong (Blue Mountains) district, and travelled over pre-arranged routes.

Three mobile 144 Mc units were located at strategic points and their purpose was to effect communication with the walking parties and relay traffic back to the main base station. In many cases communication was established direct from base to the walking stations.

The simulated search was conducted over an area of approximately six miles radius. Bearings were also taken on signals received and these will be analysed later to see if they are of any value in positioning parties. Reflections at these frequencies are, of course, often evident.

All the 144 Mc Walkie Talkie units were crystal-controlled and in their first field test they proved a vast improvement over the old modulated-oscillator units, giving better coverage and allowing better receivers to be used at base.

The four walking parties comprised bush walkers and amateurs and the following supplied and manned equipment: Vic Cole, VK2VL; John Thornwaite, VK2ATO; Perc Healy, VK2APQ; and Bob Ridgley, VK2ZAR.

Mobile stations were supplied by Harry Solomons, VK2AJZ; Cec Thornthwaite, VK2AZZO; Harry Lapthorne, VK2HL; Roy Hart, VK2HO; Keith Woodward, VK2ZAU; and John Lark, VK2ZAV. John Miller, VK2ANF; Bob Winch, VK2OA; assisted by other amateurs, operated the main base station. 18 amateurs and 14 bushwalkers attended the tests.

The organisers were extremely pleased with the results and the coverage of the Walkie Talkie equipment, signals even arriving from the bottom of valleys in rugged terrain.

A distinguished visitor to Australia lectured at the annual meeting of the VHF section of the NSW Dvision—Professor Yardley Beers, W2AWH, well-known radio authority and contributor of many articles to QST.

In an absorbing lecture he covered all phases of VHF propagation from line of sight (nearby) exchanges of signals to the recently discovered scatter method.

It was an outstanding contribution to the record of WIA lectures. Professor Beers will deliver a similar lecture to the general meeting later in the month.

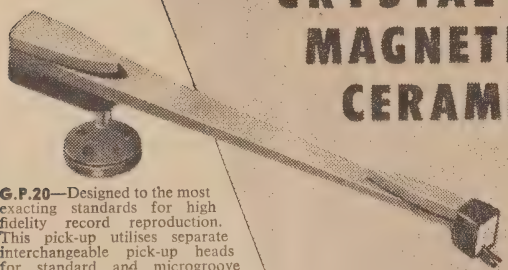
The following officers of the section were elected for the year 1956-57:—Chairman, Perc Healy, VK2APQ, vice-chairman, John Lark, VK2ZAV; secretary, Bob Winch, VK2OA; committee, Harry Lapthorne, VK2HL; Eric Dickson VK2AFM; John Thornthwaite, VK2ATO.

The section now comprises 82 members, all extremely active.

The May nocturnal hidden transmitter hunt on 144 Mc was again won by Bob Winch, VK2OA, second Eric Dickson, VK2AFM, third John Thornthwaite. VK2ATO. It is reported that Bob is soon to receive either the axe or a handicap.

acos offering the widest range of pick-ups

CRYSTAL
MAGNETIC
CERAMIC



G.P.20—Designed to the most exacting standards for high fidelity record reproduction. This pick-up utilises separate interchangeable pick-up heads for standard and microgroove recordings. **PRICE, £7/19/6.**

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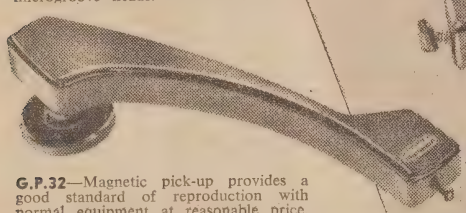
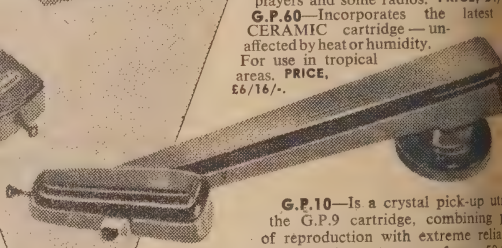
G.P.50—Is a HIGH OUTPUT c pick-up suitable for reproducing sta and microgroove records through *gain amplifiers* as used in small t players and some radios. **PRICE, £4/**

G.P.60—Incorporates the latest CERAMIC cartridge — unaffected by heat or humidity. For use in tropical areas. **PRICE, £6/16/-.**



G.P.32—Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage—½ volt at 1,000 c.p.s. **PRICE, £2/12/6.**



G.P.10—Is a crystal pick-up ut the G.P.9 cartridge, combining of reproduction with extreme relia Resonance-free response from 50 c.p.s. Output, 1.5V at 1,000 **PRICE, £3/12/6.**

H.G.P.39 CARTRIDGE—Designed to meet the most exacting requirements of modern recordings—low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available. **PRICE, £3/12/6.**

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EWS FROM UK

SION has made considerable
ct on the degree of amateur
in the UK, especially during
nonths. This is particularly
among the VHF fraternity.
it was thought that TVI was
of the inactivity and the state-
t they would be on after TV
plied as much.
e was no real reason for TVI
VHF and UHF bands closer
disclosed that it was the "lure
een" rather than TVI that was
ie dearth of operation.
sition is such that F. G. Lam-
AIW, RSGB VHF contributor,
led to amateurs to spare a little
pulate the VHF and UHF bands
hours, as well as at all other

e years now UK amateurs have
nitted to operate between 7150
s. This privilege has now been
and they must now use the
City allocations, 7000-7100 Kcs
amateur operation, and 7100-
shared with broadcasting.
J recommended that March 1,
et as a target for the clearing
services from bands allocated
for broadcasting, hence the
g.
these changes would work in
ome of our entertainment in
00 Kcs sector might be moved
B's Radio Amateur Emergency
g into operation during bad
n the east coast of England
d traffic when telephone com-
was interrupted.
expressed that if full official
n. had been afforded, even
stance could have been ren-
amateurs.
osed to official sanction and
rendered to emergency nets
USA and other countries, the
xperienced difficulty in obtain-
ct for emergency net working,
ive sponsoring by the National

e determined, however, to keep
fully operative and undoubted-
perience in other countries
y will be called on from time

ie simulated rallies have been
t and a demonstration of 144
e operation was given during
by the RAEN committee chair-
CD, presented to Red Cross
tives at their training HQ.

ND OBSERVERS

cial observers in the US pro-
similar service to our advisory
s in Australia by monitoring
ting on unsatisfactory signals
r bands.
rk under ARRL section com-
s managers and the latter are
king for experienced amateurs
observers.
vice is run entirely by the
d OO's send out ARRL co-
notice forms to amateurs whose
not to accepted standards.
only appointed from general
eurs who have suitable equip-
making checks and sufficient
" to recognise images, effects
tion conditions, receiver over-

k of observers is divided into
CW, SSSB &c. Amateurs
are proud of their self-monitor-
and the FCC have in the past
praise for the work of official

DX NOTES

the first and most valued
in the DX field is the ARRL's
table now for just on 20 years.
you can produce QSL cards
contacts with 100 different
you will be eligible for the

firmations must be submitted
the Communications Depart-
EL, 38 La Salle Rd., West Hart-
n, USA.
RL official countries list pub-
larly in QST is used to deter-
ent countries.
varies little from those pub-
ther journals and a few addi-
ds over the century should
variations.
f cards and the countries for
which they are submitted must also accompany the application. Endorsements are available for each additional 10 countries confirmed over the 100.

Contacts must be with authorised amateur stations of amateurs bands and only with land stations.

All operation must be written within a limited area and a limit of 150 miles is set for any change of QTH.

Contacts may be made over any period of years from November, 1945, and by the same station licensee. Sufficient postage for the return of the confirmations must be forwarded with the application, it is suggested that it cover first-class registered mail.

The WIA also conduct a DX Century Club and a certificate is available on the submission of 100 QSL cards. Stickers are available for each additional 20 countries confirmed.

There is no charge for the certificate for WIA members.

Cards should be forwarded to the Awards Manager, WIA, Box 2611W, GPO. Melbourne, C1.

NEW REGULATIONS

EARLY in May all radio amateurs were in receipt of a notice from the Controller, Radio Branch, covering a number of variations in conditions of operating.

For intending amateurs and listeners the following are the main sections of the notice.

Permits will now be issued covering the conducting of Television Experiments in the amateur bands from 288 Mcs and above.

No prior permission is now required for portable and mobile operation on 56 Mcs and below for periods not exceeding 24 consecutive hours.

The 50-54 Mcs band has now been replaced by the old prewar 56-60 Mcs band, in harmonic relationship with our current bands.

These variations are essentially due to representations on behalf of Australian amateurs by the Federal Executive of the WIA.

144 mcs from Tamworth

FRANK FOWLER, VK2APF, opened up from Tamworth on 144 Mcs covering a new area in NSW. He contacted VK2ANU and VK2BZ, the latter over 140 miles and heard VK2VU. He was also heard by VK2WH at a distance of 240 miles.

New Zealand stations will lose the 50-54 Mcs band to television on June 1. They will revert to the old prewar band 56-60 Mcs.

QLF, an abbreviation requesting the operator to send with his left foot if his morse by hand is not readily copied, is sometimes used in a jocular vein.

It is truly applicable to Ron Stuart, VK2ASJ, who through a disability is unable to send by hand. Using a foot-key he has even worked a few W stations.

AURORA displays coincided with poor signals on frequencies 14 Mcs and above during the last week of April. Signals fluttered for days fading out at two-second intervals rendering them unintelligible at times.

The 21 Mcs band seemed to be the worst affected and conditions did not recover for two weeks.

Jack, KH6AYG, has a very poor opinion of VK amateurs and expresses his views when contacted. Over 50 contacts with different Australian stations have not produced a single QSL card.

Probably he has some reason to be annoyed—he would appreciate all the outstanding QSL's.

A few questions and answers recently included in QST are rather to the point.

Why do amateurs use we instead of I?

Subconscious admission they are henpecked or somebody else built their rig.

Why do amateurs use Q signals on telephony when they never use CW?

To make others think they are good CW operators.

Why do amateurs tune up on an occupied frequency?

An inferiority complex.

Why do they interfere intentionally with an organised net?

To show their rugged individualism anonymously.

Notes on amateur radio from interstate sources would be appreciated for inclusion in these columns. Any activity requiring publicity will be duly covered.

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PLAYERS FROM £10/10/-'
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285 x 285 at 60ma.
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½ meg. or 25T. ohms s spindle switch pots .. ..
½ meg. or 100T. standard long spindle. .. ..
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each containing half a mile of wire.

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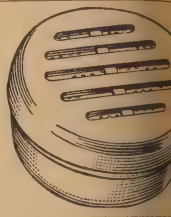

H.F. Tuning-Unit

These H.F. tuning units which are suitable for the 144Mc band contain three slug tuned coils, 7 plate ceramic trimming condensers, three acorn sockets (ceramic) and 3 new 954 acorn valves.

25/-
Plus Postage

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New 26-pin shielded plugs and sockets
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VCR-138	42/6
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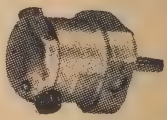
POST EXTRA

24-VOLT MIDGET MOTORS SHUNT WOUND



Fully ated Wound ture. Segment mutator, bearing ture. Ide

Model Trains, Hobbyists, etc. Cor New.

Price, each 3

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Transformer and metal rectifier to operate either of above From 240V AC **30/-**. Plus postage.

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CHASSIS ARE NEW BUT SHOPSOILED. Ideal for building into caravans, boats, etc. Size of chassis cluding dial, speaker and vibrator supply. 14in long x 10in deep x 14in high.

LIST PRICE OVER £40/-/-

SPECIAL PRICE £16/17/6 F.O.R.

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PHONE LM3610

COURSE IN TELEVISION

Continued from Page 101

output circuit, in the plate
econd triode, is normally tun-
coil being connected either
plate circuit or shunt fed,
er is preferred.

is normal, a twin-triode is
ne circuit complication and
quirements for a cascode are
h different from a pentode.
he interstage coupling is
c, the designer simply has
de for a tuned input and a
output system, treating the
s one RF stage.

CHARACTERISTICS

verall gain is high and the
vel low.

levision practice the basic
f figure 62 is often amended
the two valve sections in
cross the H.T. supply. The
circuit arrangement is shown
63, being extracted in part
complete television receiver
described in last month's
Radio, TV and Hobbies.

coming signal is fed to the
d via a tuned input circuit,
s associated with a "trap"
lter for the AGC (automatic
trol) voltage.

rst section derives its bias
his circuit, allowing the
to be earthed directly.
ver, the plate is connected,
all inductor, to the cathode
econd section. Thence, the
current flows through the
ection, through an IF trans-
to B-plus. Thus, the two
operate in series and varia-
the plate current of the first
ted as a signal directly into
ode return of the second.

Neutralisation is applied through a capacitance to the lower end of the tuned grid circuit, as distinct from an inductive return to the top end (Figure 61). It involves only a very small value of capacitance and, since the gain of the first section is quite low, the neutralising value is not at all critical.

Apart from its effect on noise level, the neutralisation also helps overcome changes in virtual capacitance with AGC voltage, thus maintaining the alignment and passband more constant.

In the circuit shown, the bias components for the second section are the conventional cathode resistor and bypass, and grid return resistor.

The effect of AGC is shared more evenly between the two sections if the grid is returned to a high resistance divider across the HT supply, set so that the grid is held just slightly more negative than the resting voltage of the second cathode.

SPECIAL VALVE

For optimum results from the series cascode circuit, it is advisable to use a twin-triode which has been designed with this service in view. Design features include suitable shielding between the two sections, good insulation of the second cathode, small interelectrode spacing to reduce transit time effects, suitable arrangement of base connections and an overall characteristic amenable to effective AGC.

Next month, we shall have something to say about mixer and oscillator stages and, possibly, the mechanical arrangement of television tuners.

npleting Your Transmitter

(Continued from page 41)

er, if you are concerned
roducing a signal, free of
monics and sub-harmonics,
everything to be said for
g an aerial tuning unit to
e transmitter to the aerial,
case the unbalanced trans-
ine is excellent. The input
eceiver can be taken from
transmission line through
g unit.

erial tuning unit can be
to feed into 75 ohm or 300
smission line and thence
les or folded dipoles for
d in the same way as be-

volves a number of separ-
ls and a neater solution is
se open wire feeders which
essfully be operated with
waves. The aerial tuning
then be used to resonate
erial on a number of bands.
ample, one version of this
erial, suitable for erection
all suburban allotment, has
t top fed in the centre with
eders 33ft long. On 3.5
erial behaves as a dipole
centre portion folded and
thus at the point of feed there is a high current and low voltage. This can be supplied by a series tuning arrangement.

At 7 Mc and all higher frequency bands the aerial requires a high voltage and low current which can be provided by connecting the feeders across a parallel tuned circuit. If the feeders are not an exact multiple of an electrical half wavelength the reactive element can be tuned out by adjusting the variable capacitor in the tuning unit. If the reactive element is large, additional capacitive or inductive elements may be needed across the line for efficient operation, but no serious difficulties are involved.

On the subject of the output circuit in general, there may have been queries in the minds of some readers as to the efficiency of the multiband circuit, bearing in mind that it does not always provide the optimum Q.

We took the trouble of providing a non-inductive resistor capable of dissipating the output of the trans-

(Continued on Page 128)

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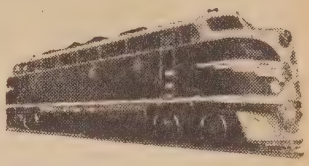

NEW

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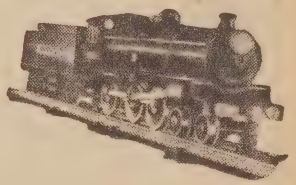

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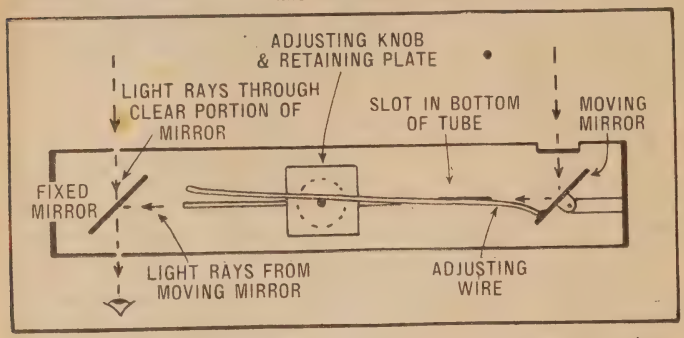
R & H

A PHOTOGRAPHIC RANGE-FINDER

From one of our regular readers, Mr. H. C. Bell of Moorabbin, Victoria, we have receive this description of a home-made photographic range finder. Although Mr. Bell describ the construction in some detail, the design appeals to us as a simple one, while an ingenio feature is the method of obtaining a linear calibration scale. For those photographers wh like to make their own, this is an ideal project.



Plan view of the complete range finder. The mirror on the left (fixed) has a clear portion through which the object is viewed directly. This image is matched with that received via the moving mirror and the fixed mirror. The angle of the moving mirror is calibrated to show the distance to the object.

THE device consists essentially of a copper or brass body, the two mirrors, one fixed and one movable, plus a simple means of rotating this mirror and relating this movement to a calibrated scale.

The tube or body is a 5in length of 7/8in outside diameter copper tubing having a wall thickness of about 28 gauge (.014in). The reason for the thin wall is, apart from lightness, to enable the largest possible mirrors to be used. This tube should have all the necessary holes drilled and the 1/32in wide slot cut along it in the position shown (Fig. 1).

Next come the mirror supports (Fig. 2 a and b). These are made from 28 or 30 SWG copper or brass sheets and care should be when drilling the holes for movable support (Fig. 2 c), that the two holes are in lin also on a line parallel to the of the support.

The two end plugs (Fig. 3 be made next, making sure th stepped portion, i.e., the part enters the tube, is a good fit end of the tube, but not so that they cannot be rotated wi fingers. This is to permit a ment of the mirrors when assembled.

The mirrors used in the o were cut from a small co mirror, such as is carried lady's handbag. These mirro usually very thin (the thinn better) and, in the writer's were just over 1/16in thick.

No trouble was experience to double images but, of cours face silvered mirrors could b

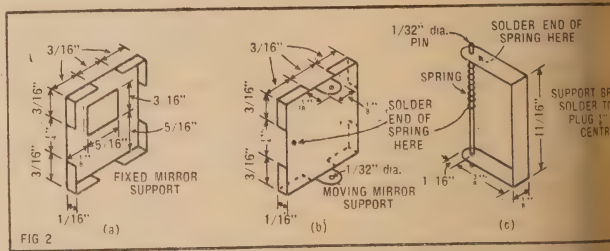


FIG 2

Details of the two mirror supports and the bracket for the moving mirror. gauge copper or brass sheet is used and the mirrors are held in place with adhesive. Note the cut-out portion of the fixed support.

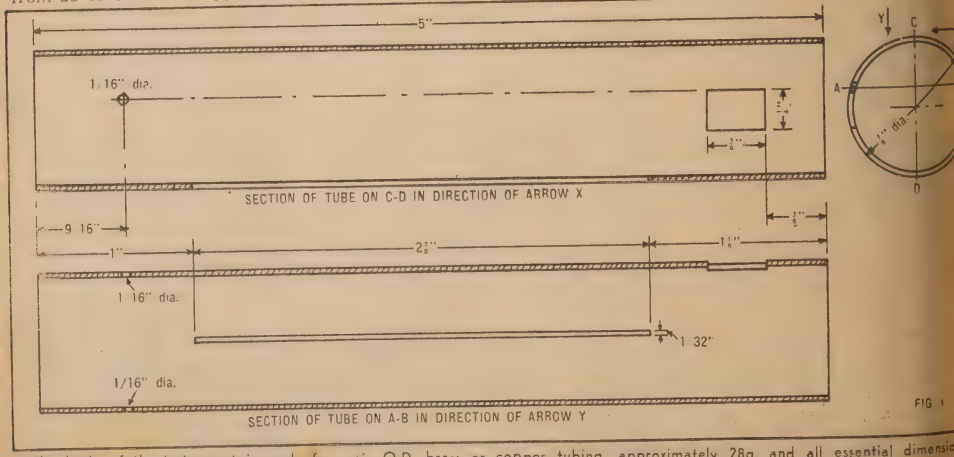


FIG 1

The body of the instrument is made from in O.D. brass or copper tubing, approximately 28g. and all essential dimensi given in this drawing. The 1/16 in diameter holes are the direct viewing holes and the rectangular hole admits the image moving mirror.

DETAIL SKETCHES OF RANGE FINDER

However, as those men- ve gave such good results, are really not necessary.

d mirror should be placed ort, making sure that the around the edge grip it i the outline of the rect- ndow, already cut in the ig. 2), marked on the back or.

the mirror and carefully e silvering from it over arked. This can be done with a razor blade and reason why it should not d right across the mirror to the lower line of the

G MIRROR

is has been done a very ntity of adhesive can be inside of the support and pressed firmly in posi- rubber-based adhesive is whatever is used, only a unt is necessary. The rror can now be assemb- same manner (no silver- d) and also fixed to its h the spring in position. of this spring should be the support bracket and end soldered to the edge rror support in such a to pre-load the mirror adjusting pin (Fig. 2b,

of 14 gauge brass wire is n the fixed mirror sup- end plug and this is so the mirror is at 45 de- tube and a line between ep holes passes through of the rectangular open-

e end plug carrying the irror is fitted to the 16 gauge brass wire is its support and roughly e shape shown (Fig. 4). job is to make and fit g knob mechanism. This a retaining plate which the tube (Fig. 5a), a which slides in the slot (Fig. 5c), and the ad- b which is fitted to the on the outside of the i).

ining plate consists of a be similar to that from body was made, but a slightly smaller radius snugly inside the main e centre of this plate is /32in diameter hole to irror actuating pin (Fig.

DED

bined pin and locating u from 1-32in sheet brass dered to the retaining own in Fig. 5c. When re should be taken that loes not run through to of the plate. If this en the surplus should off with a file.

should now be very ened so that when in- e the body and com- ard the outside, it will ency to spring inward

rminal head about 2 or d be prepared by cut- in wide slot across its e, and a cross hole 1-16in rilled through to the

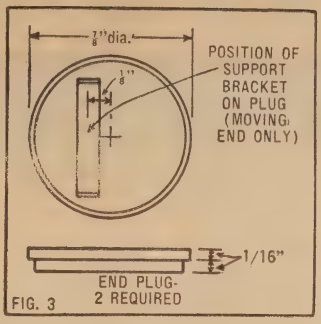


FIG. 3

The two end plugs on which the mirrors are supported. They should fit tight but be capable af being rotated for initial adjustment. Note position of support bracket.

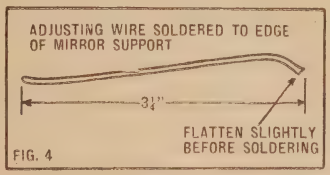
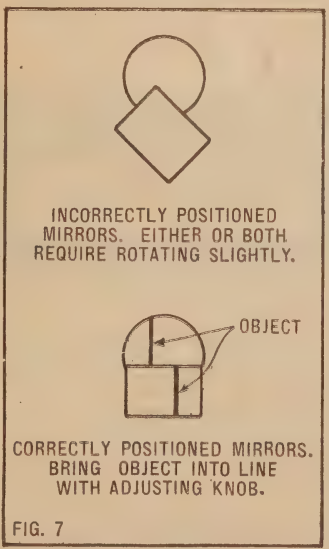


FIG. 4

The approximate shape of the adjusting wire. The actual shape will need to be determined experimentally and is best when a linear scale results.


INCORRECTLY POSITIONED MIRRORS. EITHER OR BOTH REQUIRE ROTATING SLIGHTLY.
OBJECT
CORRECTLY POSITIONED MIRRORS. BRING OBJECT INTO LINE WITH ADJUSTING KNOB.
FIG. 7

Showing the effect (top) of incorrectly angled mirrors. It is corrected by rotating the end plugs. Bottom shows the image as seen normally, the distance being read when the two images of the object are brought into line.

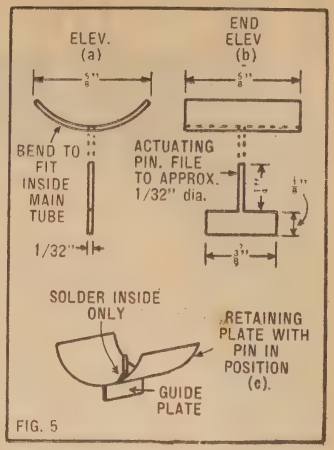


FIG. 5

Details of the retaining plate and pin. This drawing should be studied in conjunction with figure 6. The plate should be shaped to exert slight tension on the inside of the tube.

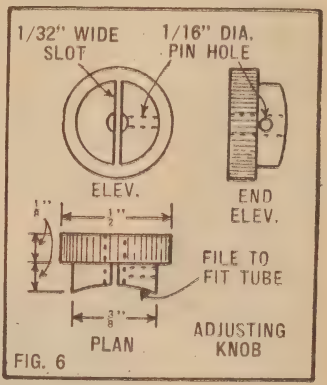


FIG. 6

The knob used to actuate the plate and pin of figure 5. It was made from a discarded radio terminal, cut and filed to fit the outside curve of the tube.

centre hole only, and at 90 degrees to the slot. (Fig. 6.) Finally with a half-round file form a slight radius on the under surface so as to approach the curvature of the body.

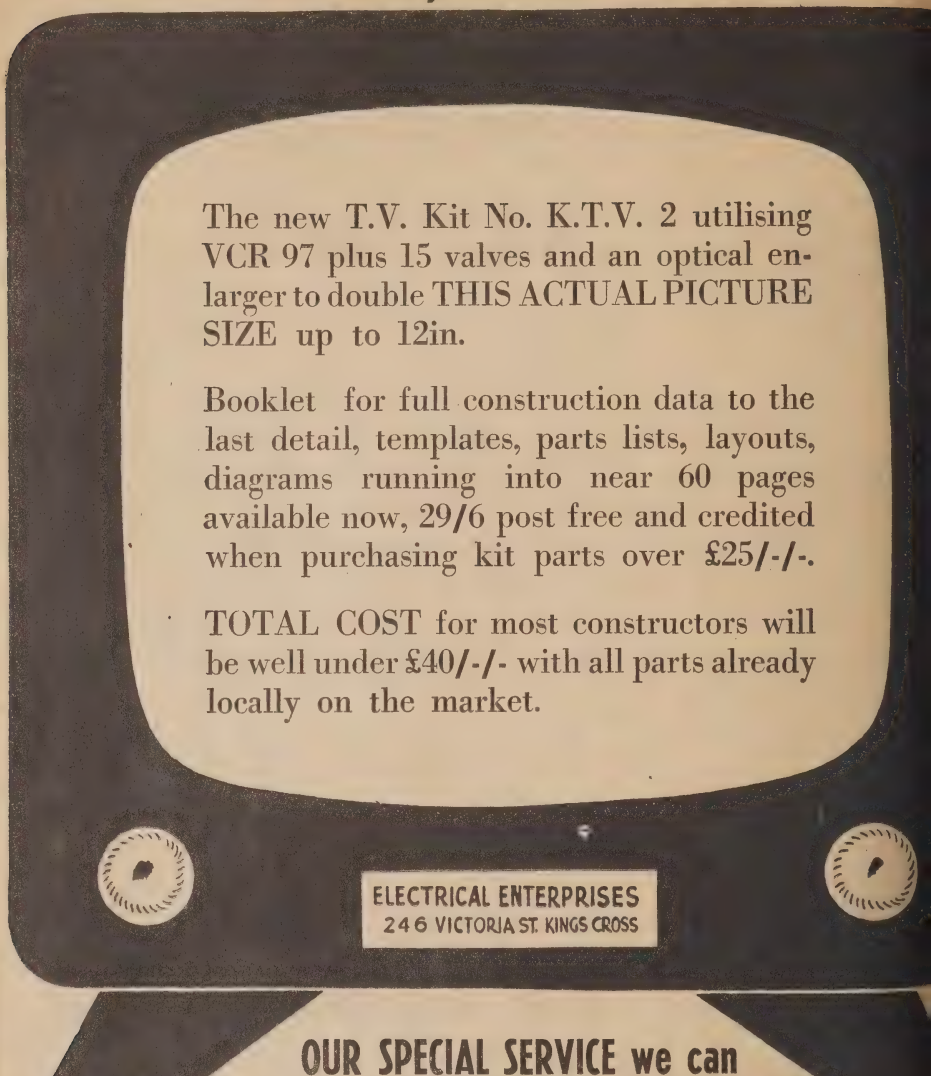
At this stage the whole of the inside of the tube, the inner surfaces of the plugs, the top surface of the retaining plate, and the back surfaces of the mirror supports, should be painted with photographic matt black.

The plate with guide plate attached is now inserted in the tube, the latter engaged in the slot, and the plate pressed outward. It should be slid to one end for accessibility and pressure applied by means of temporary packing inside the body.

The prepared knob is now placed over the projecting part of the guide plate and held tightly, while a 1-16in diameter hole is drilled through the

(Continued on Page 123)

Electrical Enterprises Presents . . .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AF MAY GET NEW JET FIGHTER

(Continued from page 11)

ownward ejection system, s kind to be installed in a n jet fighter, adds safety by the possibility of a pilot's with any part of the aero- er ejection.

t himself the pilot has only handle to start an automatic events: (a) the cockpit is ised and the control stick ard out of the way; (b) the shoulder harness snaps on ot; his legs are pulled close dy by "mechanical straps" e clamps hold the feet in) an explosive cartridge he escape hatch and jetti- seat downward and out- the pilot's seat belt un- eing him from his seat, and t altitude the parachute

ISIBILITY

ed engineers pointed out ockpit is placed well for- rlooking the Starfighter's ose, giving the pilot over- ity comparable to that of seated on the hood instead the wheel of his car.

to take advantage of the hin the fuselage for in- of equipment, the Star- ubby wings do not extend he fuselage as a single unit but are joined sep- the fuselage.

ngs have 10 degrees of dihedral — which means slant downward slightly n the leading and trailing r toward the centre line ng. The wing is located o-thirds of the distance e fuselage.

ve study of various types -including desert tests of ng models on 5in rockets several times the speed established that the Star- traight-thin wing is the naximum supersonic per- Johnson said.

is no aeroplane in the ay — even research aero- ing with a wing as thin rfighter's," he added.

FEATURES

i engineers listed two tructural features which rom the wing's extreme atio: (a) main landing lt to retract into the fuse- r than into the wing as fighters; (b) jettisonable over the wingtip like a ead of being completely opendages.

is have been made for pylon tanks if needed uel.

)4A's range is reported to rable to that of present jet fighters.

n the leading edge of the ces the plane's landing reduces its takeoff run. lso a flap on the wing ge and an aileron near p. Dive flaps, or brakes, t back of the wing and way up the side of the

ngine access door, on the bottom of the fuselage, serves a dual purpose. In addition to providing ready access to the engine, the door's inner panel holds most of the plane's hydraulic equipment, to facilitate servicing.

Another unique maintenance feature of the F-104A is attributable to its downward type seat ejection system. By removing the escape hatch underneath the cockpit, the entire seat installation can be slid down and out, thus providing stand-up working room for a technician.

The F-104A is equipped with a landing drag parachute of the same type introduced on Lockheed's F-94C Starfire jet interceptor.

The drag parachute is installed on the lower part of the Starfighter fuselage, near the end of the tail-pipe.

Dimensions of the new Lockheed F-104A are: height 13ft 6in (4.11 metres); length, 54ft 9in (16.69 metres); span, wingtip to wingtip, 21ft 11in (6.68 metres).

A PHOTOGRAPHIC RANGE FINDER

(Continued from page 121)

plate and also through the remainder of the knob, using the existing 1-16in diameter hole as a guide.

A short piece of 1-16in diameter wire is now driven into the hole and the ends cut and filed flush with the knob. The temporary packing can now be removed, when it should be possible to slide the knob easily but firmly along the tube. The slightest smear of grease applied inside the tube will assist the movement and remove any tendency to stick.

Place the knob about halfway along the tube and insert the moving mirror in such a way that the wire attached to the mirror support is on the correct side of the pin. If this is done correctly, sliding the knob along the tube in either direction will cause the mirror to rotate slightly.

TWO IMAGES

The plug supporting the fixed mirror can also be placed in position. On looking through the peep hole and viewing an object about nine or 12ft away, one should see, firstly, an image viewed directly and having a circular outline, and, secondly, there should be a rectangular image beneath the first and equally brilliant.

Rotating the plugs carrying the mirrors will bring the images into correct position relative to one another (Fig. 7), but not necessarily in line. This is done by means of the adjusting knob, which when moved to the left shifts the moving image to the right and vice-versa.

Should it not be possible to get the images into line, some adjustment will be necessary to bend the wire arm from the moving mirror.

Care should be taken when viewing not to cover the rectangular window at the end of the tube with the fingers.

OPEN SCALE

By exercising patience, with regard to the curvature of the wire on the moving mirror and to the position of the end plugs, a very good, open scale can be obtained. Also there is the added advantage that the two images are equally brilliant and, not being coincident, one does not lose one image in the other.

When doing the initial calibration the best plan is to pencil the graduations on the tube, then modify them by adjustment of the wire arm until linear or near-linear spacing is obtained. For calibration purposes a door frame, or post in the garden, is the easiest, the distances being measured accurately with a tape.

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ANSWERS TO CORRESPONDENT

D.M.C. (Epping, NSW) expresses his appreciation of the magazine and also would like to know how to connect a tape recorder to a tuner or radio receiver.

A. Thank you very much, D.M.C., for your kind words about the magazine. There are several ways in which a tape recorder can be used to record radio programs. If it can be arranged to have the two instruments alongside each other so that the connecting lead is short, the best way is to feed the tape recorder from the volume control, taking the output between the active terminal of the pot and earth. In this way any hum distortion from the audio section of the receiver is excluded from the recording. However, shielded lead must be used and the lead must be short.

Alternatively, if a long run of line between receiver and recorder is involved, it would be wiser to feed the recorder from the voice coil of the receiver, ordinary twin flex can be used, one side of which must be earthed. While in this case residual hum and distortion from the receiver audio end will be recorded, the losses in the line will not be so excessive, particularly at higher frequencies. There would be little advantage in taking the output from the plate of the output valve. Neither should the program be recorded through the loudspeaker and microphone if good quality is required, since you will be recording the distortion of both devices, as well as room echoes, &c.

S.L.M. (Killawarra, NSW) has built a transistor amplifier and is getting good results after some experimenting with the best speaker load. He is anxious to know whether the load he is using is likely to damage the transistor. He also wants to know where he can obtain coil winding data for all sizes of coils and wire.

A. Glad to hear of your experiments, S.L.M., and you seem to be getting good results. It is impossible to be sure what value load is being presented to the transistor since there is no data regarding the impedance ratio of the transformer and whether the secondary suits the speaker coil. We would regard 500 ohms as rather on the low side for best results, although there is no exact data available regarding the optimum value. However, it will not harm the transistor, only prejudice performance if the mismatch is too great. We cannot suggest any coil winding data which is likely to be better than that which you already have. We suggest you stick at the graphs until you master them.

B.J.D. (Bexley, NSW) writes to complain of the Serviceman refering to "telephone mechanics" in a recent article. He maintains they should be called "telecommunications technicians". He also draws our attention to an error in the Reader Built It article for March.

A. We have passed your letter on to the Serviceman who will doubtless comment upon your remarks. We would prefer not to comment beyond pointing out that a lot of other people seem to make the same mistake. Many thanks for drawing our attention to the error. This was unfortunately also in the original rough drawing and was not corrected when the circuit was redrawn. For the benefit of other readers the error consists of absence of HT on the plate of the Pierce oscillator, the circuit being blocked by the 50 pf capacitor.

RC (Wellington, NZ) is concerned about the loss of gain he has experienced with the No. 7 Crystal Control Unit, and would like to know how to rectify the trouble.

A.: The No. 7 Control Unit was designed for use with a crystal pickup and a Playmaster power amplifier having an input sensitivity of no less than 300 millivolts. As the output from crystal pickups is often considerably more than this, it was necessary to design the control unit with quite low gain. Looking at the valve line-up of your amplifier, it is quite possible that it has a considerably lower output sensitivity, possibly of the order of 2 or 3 volts. The solution would be to increase the plate resistor of the EF86 until the control unit is capable of driving the amplifier to full output without distortion. If this gives no appreciable improvement, it may be necessary to rewire the valve as a pentode. Circuits for the EF86 used as a pentode have appeared in many recent issues of the magazine, in conjunction with Playmaster amplifiers.

F.R. (Sorrento, Vic.) would know if we have published a for a simple AC inverter for u electric razors. His other qu whether such a converter could to run an AC/DC portable.

A. A simple AC inverter was p in our April, '51, issue, F.R. Th most certainly be used for an razor, as its rating is about 2 on continuous load. Whether th inverter could be used for a will depend on the consumption set but it would most likely be Circuit and constructional det the converter are still availab this office through the 2/- query

N.V.B. (Chadstone, Vic.) is inqu last year's promised article on crossover networks for 20hm following the design for 15 ohm in the October, 1955, issue.

A. As intimated in the Octob the idea for 2 ohm speaker networks presents problems in t ponents required to do the job, till the present we have not be to carry the idea further We forgotten it however.

A.S.D. (Kawa Kawa, NZ) requ winding data for a receiver usi Kc IF and covering both broad short wave.

A. Sorry, A.S.D., but this is of specialised query which we not handle. The best we could be to forward our pampilet Winding Data For Small Receiv might help as regard the aerial coils but there is no oscillator da you seem to be most interested broadcast band we suggest it more satisfactory to purcahse the made, since they are normally from the leading coil manufactu

KF (Mascot, NSW). We have ters to hand from you, KF. quired whether the compensation submitted would be suitable for ing a crystal pickup to a five ceiver and the other one a reques circuit of a two-valve receiver.

A.: The circuit submitted is able for a crystal pickup in co with an ordinary broadcast rece cause it was designed to reduce put from the pickup to make it for feeding into a low level input There would not be enough volta able from the network to feed a receiver. The best plan wou feed the pickup straight into th terminals of the receiver. Cir any design published in the are available through our 2/ service, as indicated on these p you let us know your requirem will be able to send a suitable ci

J.A.H. (Nedlands, WA) writes us for what he finds a very publication and adds the sugges the partial triode connection put valves may also be appl single ended amplifiers.

A. Thanks indeed for your le suggestion is well worth seri sideration in the case of a sing quality amplifier but at the s amplifiers making real claim t these days are usually push-p several distortion components matically eliminated by the connection. We will keep the tion in the "ideas basket".

A.K. (Gladesville, NSW) has All-Wave Battery Two receiver ation for over a year and is ver with the results.

A. Thanks indeed for your le the list of stations you enclose is impressive. No, we do no mend the "Set for Young DX operation above 32 Mc/s. In a the performance of such small falls off very seriously abo 20 Mc/s and even extending t to 30 Mc/s is stretching things.

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Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

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d in series with each rec-
hen substituting a 425 volt
rmer in place of the 400
ansformer specified for the
master" No. 12 amplifier.
e of these resistors cannot
from any simple formula
easiest to determine by ex-
lowever, from experience
gest that 125 ohms would
value. There is no need
separate resistors one in
d as the same effect can
y a single resistor between
er centre tap and earth,
a suitable power rating
watts. Valve type Z729 is
alent to type EF86 and the
interchanged without any
owever, the two valves are
by different companies and
ake claims as to their re-
ty. The necessity for an
rmer cut-out depends on
utput transformer and we
osition to comment without
ation. Many thanks indeed
iative remarks.

arat, Vic.) wants to know
circuit of a portable set,
for AC mains operation,
six to eight valves, and
20 metres to the broad-

.T.S., but we have never
thing quite as elaborate
have described a number
eceivers suitable for both
nains operation but these
confined to the broadcast
ited to five valves. In
little point adding more
t is doubtful whether the
n would be of any real
dition it would increase
drain which could hardly
The provision of a short
a portable receiver appears
appeal, particularly as it
be necessary to provide
aerial before worthwhile
be obtained. We suggest
the Rambler Portable
November, 1953) or the
le (December, 1951) might
uirements and these may
hrough the normal postal

n, NSW) says he has an
receiver and would like
me system of bandspread.
far more to the problem
ar to imagine, H.L. To put
bandspread system would
proportion to the value of
et — even assuming that
ranged in the space avail-
st we can suggest is that
two or three plate midget
itor in parallel with the
ion of the tuning gang.
l be realigned with this
osition but normally fully
ng the plates into mesh
ver a portion of the spec-
frequency than the dial
ould have to provide some
and indicator to calibrate
acitor and its setting would,
dependent on the setting
ning gang. The system
ed to spread a small sec-
ectrum at a time, since it
ressive detuning of the
circuit.

ong, Vic.) proposes to use
nsistor set as a portable
aerial coil with a loop-
d like to know the number
s on the loop stick.
ted out in the original
nsistor receivers, such re-
ry low RF sensitivity, and
ected to work well with
While the loopstick is
cient than a conventional
t likely that it will be
transistor set.

NSW) writes to tell us
tion of the simple receiver
he October, 1952, issue.
ow if a 3-volt battery can
ace of the 1.5 volt type.
s to connect a crystal
the 2-valve record player
955, or a mantel receiver
a pre-amplifier described

A. In no circumstances should you connect a three-volt battery to the filament of the 3S4 unless the connections are altered to permit this. Otherwise the valve will be quickly ruined. In any case there would be nothing to gain by doing this, and the valve would function essentially the same as when the 1.5 volt arrangement was used. The Two Valve Record Player is hardly suitable for microphone work and we have no pre-amplifier which would suit it. We would suggest as a basic amplifier the Baby 4 Watt Amplifier of February, 1950, and the microphone pre-amplifier of January, 1955. Without some details of the mantel receiver we cannot advise whether this same pre-amplifier would be suitable.

B.M.B. (Indooroopilly, Qld.) writes to the Serviceman to comment on some of the problems recently discussed concerning oscillation in audio amplifiers.

A. Many thanks for your letter and comments, B.M.B., and we will pass your letter on to the Serviceman for his possible comment. In the meantime we would confirm that the output transformer is most certainly the "nigger in the woodpile" when it comes to feedback. In fact, 25 db of feedback, which includes the transformer in the loop, is an extremely risky business. In general between 15 and 20 db are typical values, the higher one only when the transformer is a particularly good one and the gear can be thoroughly checked.

T.C. (Bellevue Hill, NSW) expresses his interest in the Playmaster FM tuner described in the May, 1955, issue. However, he wonders if we intend describing a combined AM/FM tuner in the near future.

A. No, T.C., with only one experimental FM service at each location we cannot justify the development of such a tuner at the moment. However, if you are personally keen to study the designs already published a check through overseas periodicals, particularly European, may be rewarding. Some of the valve companies have published combined AM/FM receiver designs.

K.A.L. (Concord West, NSW), having just taken up radio as a hobby, would like to further his knowledge with reprints on the "Teach Yourself Radio" series.

A. This series was featured in monthly instalments, from August, 1952, to April, 1953, inclusive. Copies of the circuits for building up a crystal set to a three-valve battery B/C-S/W receiver are available in six separate lots. The total cost for these would be 4/- through the query service. However, in your case, it would be better to have the text of the articles as well. Perhaps you may care to advertise for copies of the magazines in the "wanted to buy, sell or exchange" columns.

(Continued on Page 127)

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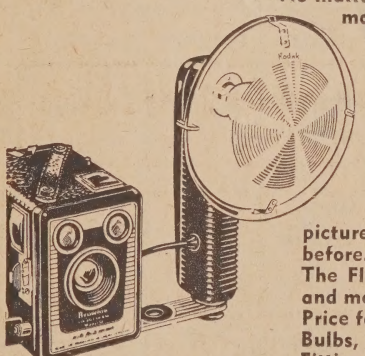

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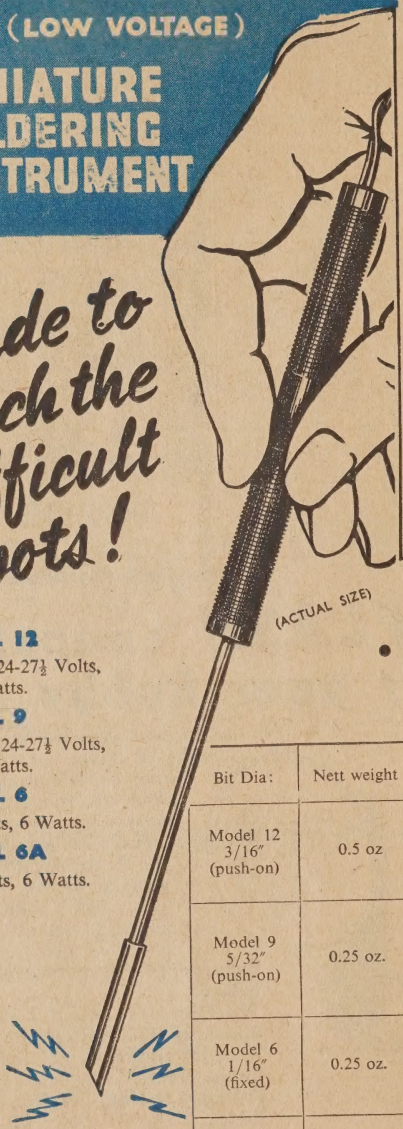

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MODEL 9
6, 12, 24-27½ Volts, 8.3 Watts.

MODEL 6
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MODEL 6A
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Model 9 5/32″ (push-on)	0.25 oz.	6″	Hearing Aids, Midget Radios, Pers ceivers, Radio and T/V Sub-Assembli Electronics, Instruments, Model Con Electro-Medical, etc.
Model 6 1/16″ (fixed)	0.25 oz.	6″	Electrical Measuring Instrument Fin blies, Hairsprings, R.F., Pick-up, Spee Hearing Aid Sub-assemblies, etc.
Model 6a 3/32″ (push-on)	0.25 oz.	6″	As for Model 6 (for extremely delic only)

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cot, NSW) has just bought a crophone and finds that it volume when connected to terminals of his 5 valve radio However, he also wishes to double button carbon micro- alternative and wonders how be done.

double button carbon micro- will need a transformer with pped input winding stepping fairly high impedance, say s and a small battery to e buttons. Three volts is the e. The microphone diaphragm l via the battery to the centre- transformer primary and each ons is connected to one of the mary wires.

elong West, Vic.) is interested ruments.

are a number of difficulties in n efficient valve tester which be duplicated by home con- ithout access to special parts, possible that we will publish some time in the future, but we are not in a position to lefinite promises. We do not there would be much future the recent VTVM design h the requirements of a valve would be much more con- begin with a completely licating instrument.

istow, NSW) inquires about lity of transformers for the eceiver. He would also like a 3in loudspeaker would be h this receiver.

ple of our advertisers have formers available for the er and it is a standard line ast one of them, Ferguson s of Chatswood. For inform- ling the supply position we st you contact them directly. peakers no doubt could be work with the Transistor y are very inefficient and a would be preferable. In larger the speaker and its more efficient it is, and the er which can be accommo- be used.

est Tamworth, NSW) wants mbined radiogram and tape he one cabinet, though he is mewhat by lack of radio However, he hopes to enlist friend.

e described a great number radiograms, amplifiers, con- l tuners in the past as well e amplifiers, but it is rather y which combination would our particular case. In any gest that the tape recorder a separate project, preferably e. This should not cause any vided space is left for the deck and for an amplifier, which may suit the 1955 September 1955) and a copy vailable through our postal Tape Recorder No. 1 52) or Tape Recorder No. 2 should serve as a guide for nd are also available through rvice.

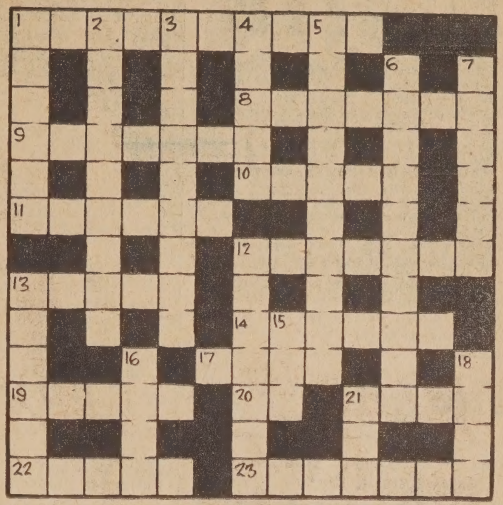
nt Cook, Vic.) has a moder- tery receiver which is cap- ng very good results and ld now like to operate from

t describe a power supply eplace the batteries in cur- ortable receivers, but this entirely suitable for your the best it would probably the HT power, leaving the bias circuits to be supplied . This need not be a hard- n accumulator (preferably nall glass type such as the nd small charger can supply and the routine replacement batteries is not expensive. e power supply (October obtained through the postal

n, Vic.) has built the Short ter of June, 1955, but is of bother. The oscillator fail to function and the al adjustments only shift

ather difficult to diagnose t a distance, P.B., but we

THE R., T. & H. CROSSWORD No. 26



ACROSS

1. Describing electron emission in a valve.
8. Rubber vulcanised with sulphur.
9. Trying.
10. Positive electrode.
11. Beverage serving utensil.
12. Choice and use of words.
13. A recurrent series.
14. Type of saw
17. Component of a TV picture.
19. Contact by electromagnetic waves.
20. To exist.
21. To take part in a game.
22. Ground.
23. Formal permission.

DOWN

1. Type of oscillator.
2. Reciprocal of capacity.
3. Tapped on to communication circuit.
4. Greek "O".
5. TV camera.
6. Chronometrical indication over the radio. (2 words)
7. Part of an aerial system.
12. Unit of power-level difference
13. The quantity of electricity on a body.
15. Unity.
16. To dye.
18. Lake in Central Australia.
21. Prefix meaning before.

Solution and further crossword next month

gain the impression that the oscillator circuit is not working and such signals as you are receiving are the result of Some freak condition. The most likely explanation appears to be that the RF stage is oscillating and acting as a crude converter. This could be due to poor wiring or layout, &c., while the failure of the oscillator circuit to function could be due to incorrect coil connections or a faulty component in the oscillator circuit. We suggest it might be best if you enlisted the aid of someone with a little more experience.

D.H.C. (No address) wants to know how to receive amateur stations on an ordinary radio.

A.: Any dual wave receiver will pick up amateur transmissions on the 40 and 20 metre (7 and 14 Mc) bands and it is only a matter of listening at the right time. A broadcast set cannot receive these signals unaided and the simplest solution in this case is to use a short-wave converter. Two of these were described recently (June and July 1955) and we can supply circuits through our postal service. Incidentally we always prefer letters to carry the full name and address of the writer; not neecssarily for publication.

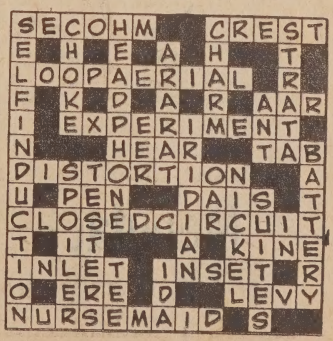
K.Q. (Dandenong, Vic.) would like some information on commercial and ex-disposal communication receivers.

A. Sorry, K.Q., but this type of question is not within the scope of the query service. We would like to help you but it would be quite impossible for us to set up an extensive library on information dealing with other than our own designs.

P.T.L. (Salesbury, SA) asks if the dual-wave five valve battery receiver described in the March, 1955, issue of Radio, TV and Hobbies, could be operated from a 67.5 volt rather than a 90 volt supply as specified. The broadcast band only is required.

A. The answer is yes. Disregarding factors such as battery life, the procedure would be to eliminate both the 900 ohm dropping resistor in the oscillator HT circuit and the common .02 meg screen dropping resistor for the 1T4's. The power output of the receiver and also the gain would be somewhat reduced but the receiver should still be an excellent performer. Some reduction in battery drain, at the expense of power output could be achieved by increasing the back bias resistor from the present 450 ohms to 600 ohms.

Last month's solution



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FOR SALE: Large quantity of radio parts including 30 valves, transformers, chokes, condensers &c., £5 the lot. **Douglass, Tiral St., Charlestown, N.S.W.**

FOR SALE: All back issues of R. & H. still available, good stocks 4/- per copy incl. post. **T. Weir, 73 Gibson Ave., Padstow,** 1943 to 1950, £1 per year incl. post. Wanted to buy copies in good order **UY8056.** Enquiries welcome.

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SELL: Precision Drill Castings & Print. **Bolton, 72 King St., Sydney.** Catalog. 4/-.

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WANTED: AT5/AR8 instruction manual. **K. Ness, 17 Haigh St., Nailsworth, SA.**

WANTED: Coil winding machine with counter. Details to **The Electronic Organ Company (Australia), 11 Cadow Street, Pymble, NSW.**

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Cost of Classified advertiseme section is 2/- per line, ap five words to a line. Closin July issue of Radio, Tele Hobbies is Wednesday, J

COMPLETE YOUR TRANSMITT

Continued from Page

mitter. With the input to of the 6146 adjusted to t mum the RF voltage acro sistor was measured wit frequency valve voltmeter knowledge of the voltage resistance, calculation of frequency power was a si ter.

Figures so gained, comp similar measurements on tional type tank circuits that the efficiency of the circuit is high. The meas put at 28 Mc was almost at 3.5 Mc and the efficie 65 pc, a typical figure f adjusted parallel tuned ta arrangement.

We would like to publis results of our measuremen not, as yet, completely sat certain sources of second e have been minimised and a detailed account is likel more informative than general statement.

Our remarks on the e and general convenience transmitter have been we ed by using it on the air weeks and our vote is tha worth the time and trou has gone into its construc

For those who alread transmitter, many of the i published design could w to use to make for a mo station.

In conclusion, we are v that there are many po the design which could discussed in more detail sories to the transmitter have not described as would be of great interes readers. However, many books have been written ject and we cannot hope the information in a few R. TV & H.

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